ISSUE 9

CURIOS.TY

Research . Rethink . Relearn

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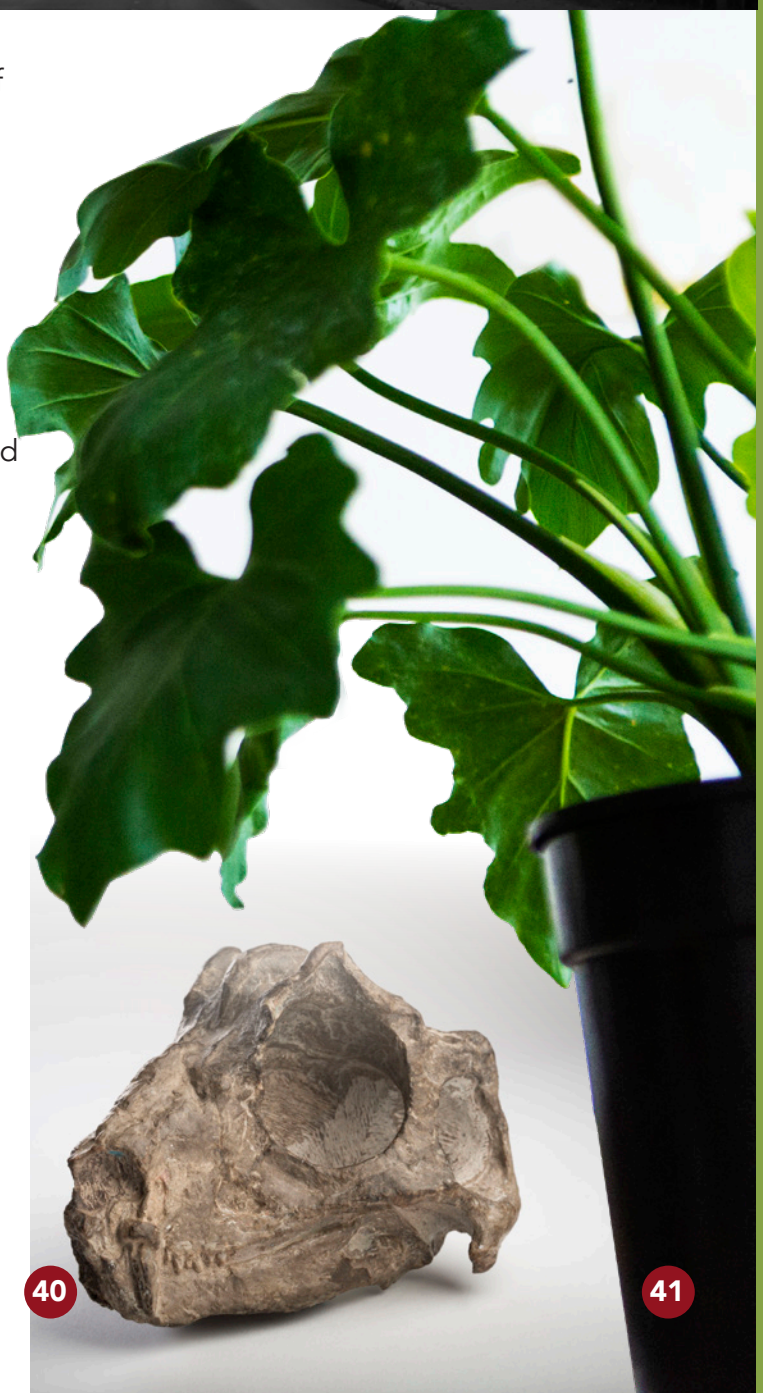

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

GREEN CROSS NEEDED TO HALT THE CLIMATE EMERGENCY

Climate emergency has been declared the "word of the year" by Oxford Dictionaries, based on increased use of the term globally. We are in an environmental crisis and it may be too late to completely reverse the effects of climate change.

The climate crisis is an emergency and deserves the highest priority by individuals, cities, governments, corporates, civil society, the media and universities. Each one of us needs to own the climate emergency and act daily – we have the agency and the power to effect real change and to impact society now and for the benefit of future generations.

As a leading university in Africa, Wits must lead by example and use its influence to transform society through its leadership, education, and research. The Talloires Declaration of 1990 – the first official statement made by university leaders of a commitment to environmental sustainability in higher education – recognises this responsibility. The statement raises concern "about the unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources". Universities have a significant role to play in achieving sustainable outcomes that benefit everyone.

Universities can address the climate emergency by prioritising sustainability and climate change through interdisciplinary research – the Wits Global Change Institute, with input from various faculties, leads in this respect; through empowering students, staff and individuals to tackle the emergency; through social leadership; and through building green campuses.

We can use our intellectual prowess to develop critical thinkers who are cognisant of the effects of climate change and who can tackle the emergency with fervour. We have an opportunity to provide our communities with graduates who have the knowledge and skills necessary to transform society and to live as responsible local and global citizens. Indeed, many Wits academics, researchers, scholars and social activists are already leading the charge on this front. Our students have just developed a cost-effective, modular-based solar energy kit that reduces e-waste, and which can be used in un-serviced and under-serviced communities.

Wits is also reimagining its physical and digital infrastructure to reduce its environmental impact, for example, through adopting an energy efficiency strategy that includes the use of renewable energy, and through the introduction of new online digital offerings. Recently, Wits implemented efficiency programmes that include rooftop solar PV installations; green buildings; building management systems; indoor lighting retrofits; sustainable hot water systems for residences; water, storm water and waste water assessments; food security; transport systems; green procurement policies; and effective land and waste management systems.

In short, we do not have a choice. It is incumbent on each of us to tackle the climate emergency. This #ClimateEmergency issue of *Curios.ty* features questions, challenges, issues – and some of the answers – about how we can map a sustainable way forward. Please share your #ClimateEmergency thoughts with me via curiosity@wits.ac.za.

Professor Zeblon Vilakazi
Deputy Vice-Chancellor: Research and Postgraduate Affairs

Curios.ty is a print and digital magazine that aims to make the research at Wits University accessible to multiple publics. It tells the stories of pioneering research at Wits through the voices of talented researchers, students and academics. First published in April 2017, *Curios.ty* is published three times per year. Each issue is thematic and explores research across faculties and disciplines at the University that relate to this theme. Issue 9 of *Curios.ty* is themed **#ClimateEmergency** and refers to global change, climate change, the Earth, and the impact and implications of 'going green' (or not) on people, places, and politics. We interrogate the issues of population vs. birth control, the silver lining in the climate crisis, and the gold in cell phone mines. We investigate green jobs and green tyres, climate engineering, green alternatives to dirty words, and Asian Tigers and pangolins. We explore how heat affects matric results, how your office plants can heal, the war on waste pickers in your street, and what Justice Edwin Cameron says about animal rights. We interview Miss Earth SA 2019, report on how Wits is going green and expose the legend of the purple Jacarandas on campus.

Shirona Patel
Head: Communications

Dr Robin Drennan
Director: Research Development

Reshma Lakha-Singh
Public Relations and Events Manager and *Curios.ty* Project Manager

Refilwe Mabula
Communications Officer

Deborah Minors
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Schalk Mouton
Senior Communications Officer and *Curios.ty* Editor

Erna Van Wyk
Senior Multimedia Communications Officer and *Curios.ty* Digital Director

Buhle Zuma
Senior Communications Officer

CREATIVE DIRECTOR
Lauren Mulligan

LAYOUT AND DESIGN
Nadette Voogd

COVER
Lauren Mulligan

PRODUCED BY
Wits Communications and the Wits Research Office

Fifth Floor, Solomon Mahlangu House, Jorissen Street, Braamfontein Campus East

TEL: +27 (0) 11 717 1025
EMAIL: curiosity@wits.ac.za
WEB: www.wits.ac.za/curiosity

FEATURED

RESEARCHERS

A number of Wits experts are featured in this edition of *Curios.ty*. View the profiles of all the researchers and contributors at: **www.wits.ac.za/curiosity/**

SALLY ARCHIBALD

Sally Archibald is an Associate Professor in the School of Animal, Plant and Environmental Sciences at Wits. Her research interest is to understand the dynamics of savanna ecosystems in the context of global change. Her work integrates field ecological data, remote sensing, modelling, and biogeochemistry. She is involved in international research collaborations on fire-grazer interactions, inter-continental savanna comparisons, the importance of land-atmosphere feedbacks, and pursuing a global theory of fire. She is affiliated with the Global Change and Ecosystems group at the Centre for Scientific and Industrial Research. (Story: pages 30-33)

FRANCOIS ENGELBRECHT

Professor Francois Engelbrecht joined the Global Change Institute (GCI) at Wits in 2019 with a mandate to increase the University's capacity for climate modelling. He was previously Chief Researcher at the Centre for Scientific and Industrial Research. He has worked on the Lengau Cluster, the most powerful supercomputer in Africa, hosted at the Centre for High Performance Computing in Cape Town. He is a Lead Author of the Intergovernmental Panel on Climate Change (IPCC)'s Assessment Report Six, to be published in 2021. (Story: pages 22-25)

THOKOZANI MAJOZI

Thokozani Majozi is a professor in the School of Chemical and Metallurgical Engineering, where he also holds a NRF/DST Chair in Sustainable Process Engineering. He was previously an Associate Professor in Computer Science at the University of Pannonia, Hungary, from 2005 to 2009. He was a Commonwealth Scholar at the University of Manchester Institute of Science and Technology in the UK, where he completed his PhD in Process Integration. Majozi is author and co-author of more than 200 scientific publications, including four books in Chemical Process Integration. (Story: pages 16-17)

WARREN MAROUN

Warren Maroun is a Professor of Accounting in the School of Accountancy at Wits. He is a member of the South African Institute of Chartered Accountants and the Chartered Institute of Management Accountants. His research interests include integrated reporting; corporate reporting; external audit and corporate governance with a specific focus on the functioning of mechanisms of accountability. Maroun has published over 50 journal articles and has produced technical and practitioner-focused reports for industry bodies. He holds a PhD from King's College London. (Story: pages 36-37)

POPPY MASINGA

Dr Poppy Masinga is a Senior Lecturer in Social Work, School of Human and Community Development, where she teaches community development, programme design and management, and social policy. Her PhD focused on designing a school violence prevention programme. She is an advocate for human rights and social justice, particularly for children and the youth, and has an interest in immigrant issues. Her current research is a collaboration on the topic, *Social injustice through the eyes of social work students: Perspectives from South Africa, Switzerland and Germany.* (Story: pages 6-7)

PRESHA RAMSARUP

Dr Presha Ramsarup is the Director of the Centre for Researching Education and Labour in the Wits School of Education. She was part of the team that produced South Africa's first Environmental Sector Skills Plan and was the National Coordinator of the National Green Skills Project. Her research focuses on supporting green skills development through an employer-led demand project to identify green jobs, as well as researching opportunities to 'green' traditional jobs across different sectors. She co-authored *Green Skills Research in South Africa: Model, Cases and Methods* (Routledge, December 2019). (Story: page 21)

MYER TAUB

Dr Myer Taub lectures in the Theatre and Performance Division in the Wits School of Arts. He is an award-winning multi-disciplinary artist whose one-woman play, *Florence*, premiered to critical acclaim in Johannesburg in 2018. As part of an ongoing performance project, he has been walking the water-spruit in the suburbs of Waverley and Melrose. This is part of an embodied ecological investigation into the counter urban narratives of the city and water. Taub won the National Institute for the Humanities and Social Sciences African Pathways BRICS Award for his WILD ZONES research into city spaces as catalysts. (Story: pages 26-28)


SALLY ARCHIBALD


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THOKOZANI MAJOZI


MYER TAUB


WARREN MAROUN


ANDREW THATCHER

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Professor Andrew Thatcher is Chair of Industrial/Organisational Psychology at Wits. His current research interest is developing a model of a sustainable system-of-systems for human factors and ergonomics; workplace layout and its impact on health and wellbeing in green buildings; and the impact of plants on health, wellbeing and effectiveness in office environments. He was the first person in South Africa to evaluate wellbeing and effectiveness in green buildings in this country. He chairs the International Ergonomics Association's Human Factors for Sustainable Development Technical Committee and co-edits *Ergonomics*. (Story: pages 13 and 41)

UNIVERSITIES HAVE A MORAL OBLIGATION TO STAND UP AND LEAD

UFRIEDA HO

With the world facing a climate emergency, institutions of higher education have a leading role to play in securing a future for our children.

Universities have a privileged seat at the table of knowledge. However, climate change is the great leveller. To survive and adapt in this changed world, it makes sense to pull up chairs for indigenous knowledge and local wisdom to face these challenges.

For Dr Poppy Masinga, Senior Lecturer in the Department of Social Work at Wits, a return to working with the Earth and the elements represents way to build the survival strategies needed for a world of shrinking resources and unsustainably high reliance on industrialised food production, wasteful practices and over-consumption.

"I'm 60 years old now and I remember growing up in the rural areas, you could eat wild potatoes, wild berries and locusts – people knew where to find them and how to prepare them. When I tell my children these stories, they just laugh," she says.

OLD WISDOM FOR NEW EARTH

Masinga isn't advocating for pizza night to be scrapped in exchange for foraging for insects and tubers (just yet), but she says old wisdoms should be recognised and incorporated into modern, structured learning. She says now more than ever there should be respect for working with ecosystems so that they in turn support human beings.

She believes that it is the kind of thinking that should inform how the next generation of social workers are taught. It's not about ghettoising indigenous knowledge or reducing it to a "nice to have" but about embedding it in formalised knowledge production, she says. And this will place the right pressure on politicians and policymakers to make a commitment to direct resources towards these goals.

Social workers are the professionals at the front line of helping the marginalised people in our societies to survive better. "The most detrimental consequence of environmental injustice is climate change, which poses a threat to food security and access to clean, safe drinking water. The long-term impact is on all other systems, with the poor and vulnerable suffering the most. There is a need for curriculum transformation and integration of theoretical and philosophical perspectives and principles of radical social work practice," she wrote in an abstract with colleagues Dr Thobeka Nkomo and Dr Nontembeko Bila.

BEST OF WEST AND AFRICA

Universities need to educate students to confront social injustice, inequality and the oppression of minorities. This, says Masinga, is an ethical and moral imperative that cannot be ignored any longer.

"We have become accustomed to thinking that the Western way of doing everything is the only way, but when we combine the two – of western ways and our own African ways – we get the best of two worlds," Masinga says.

Dr Darlene Miller in the Wits School of Governance has been trying to change the status quo. In 2014/15, when she was at the University of the Western Cape, Miller and her then colleagues Dr Nomalanga Mkhize, Dr Babalwa Magoqwana and Rebecca Pointer created an initiative called the Green Leadership Schools (GLS) as an alternative approach to decolonising the university landscape.

Through the Green Leadership Schools, Miller and her colleagues aimed to provide a new approach to university curricula that "allows for the integration of the environment" into all aspects of learning at universities.

"The curriculum of the GLS [introduced at four sites in South Africa] dealt with land, gender and leadership and how these are related to crucial environmental issues such as climate change and indigenous knowledge," says Miller.

"Finding alternatives to westernised knowledge is not easy, given the historical ruptures that have occurred in Africa. We face an epistemic challenge to find our way back to the beauty of the indigenous rather than the reaction of traditionalism. This endeavour is integral to the decolonisation of universities. The present university system still constrains the growth of black intellectuals and professionals and what we looked at was a radical alternative based in a grounded research method."

"Universities need to choose a side. Scientific rigour remains at the heart of science and research but universities can't be neutral about environmental justice any longer."

TAKING A STAND

Another shift for universities will be to nail their colours to the mast in the fight for environmental justice, says Robert Krause, a researcher based at the Environmental Justice Programme in the Centre for Applied Legal Studies (CALS) at Wits.

"Universities need to choose a side. Scientific rigour remains at the heart of science and research but universities can't be neutral about environmental justice any longer," says Krause.

Universities have leverage and power, which Krause believes should be aligned more unequivocally to people who are often left to stand up against corporate polluters like mines and factories.

Krause sees potential for the exchange of knowledge, collaboration and for deepening partnerships between universities, communities and other civil society structures.

For instance, students can learn from the context and nuances that communities affected with the challenges of climate change live with. In return, the collaboration means these communities can be empowered to contribute to gathering data and evidence against offending companies, for CALS to build cases against polluters.

It is these kinds of partnerships, Krause says, that will help test the limits of legislation such as the National Environmental Management Act in holding polluters to account through real penalties.

"We know the next 10 or 15 years are critical to reduce CO_2 emission levels to avert a climate crisis," says Krause. "Economic power is still what makes default decisions for us, but we need to be able to build counter power through organising and mobilising communities."

THE BURNING ISSUE OF POPULATION CONTROL

The increasing human population is putting large amounts of pressure on our natural resources and is contributing to climate change, leading many people to call for increased population control – especially for poorer communities. Beth Amato investigates whether this could be a solution to decrease the rate of climate change.

While the world's resources are limited, increasing population figures are adding pressure on both our available resources and the rate of climate change. The human population has doubled since 1960 and currently stands at 7.7 billion. The United Nations estimates that it will continue to 9.8 billion by 2050.

It is no secret that humans have too large an impact on the sustainability of our planet. According to the World Wide Fund for Nature (WWF), we currently need 1.6 Earths to produce all the renewable resources we need. We are using far too many resources, and every person living on the planet is adding to that impact. Concerns over climate change have led to ever increasing calls for population control to mitigate our impact on the planet.

In a letter to *The Star* Newspaper in May 2019, for example, a letter writer voices this call, writing that "work needs to be done to educate Africa's people about the benefits of having small families".

"Unless Africa gets a good handle on its out-of-control population growth, the continent will continue to be the beggar of the world, unable to take care of its own," the letter writer said.

Like many others, this letter writer believes that overpopulation is the "elephant in the room" and the direct cause of deepening poverty and environmental degradation.

Celebrity environmentalists such as Jane Goodall and Sir David Attenborough are only some examples of people who have added their voices to the plea for greater population control to avoid the devastating freefall into ecological mayhem.

THRIVING (SELECTIVELY) TOGETHER

As an ambassador for the Thriving Together campaign, led by the Margaret Pyke Trust, Goodall is at the forefront of advocating for the "removal of barriers to family planning" for the health of women, all humans and our fragile ecosystems. The trust is supported by 150 global organisations, including the United Nations.

"Women everywhere must be able to choose whether to have children, how many children, and the spacing between them. This is critical for their own wellbeing. But, they also need to be equipped with the knowledge as to how their choice affects the health of the planet and thus the future of their own children," says Goodall.

"The Thriving Together statement demonstrates the widespread support and attention that this issue is finally beginning to receive from both the conservation and reproductive health communities."

While women and girls should have autonomy over their bodies and have access to reproductive health services, Goodall has been criticised for not necessarily and primarily being motivated by women's freedom and justice.

UK columnist Ella Whelan wryly asserts that "Thriving Together is prioritising beetles over black people … There is something deeply unpleasant about white environmentalists like Dr Jane Goodall and Sir David Attenborough fronting these campaigns to strongly discourage women in developing countries from giving birth to 'too many' children."

While the world's resources are certainly limited, highlighting the link between climate change and fertility rates in poor countries fails to confront the deep systemic issues that have driven mass ecological damage, says Distinguished Professor of Public Health and Medical Anthropology at Wits University, Lenore Manderson.

The World Economic Forum, and data analysis organisation Our World in Data, both show that North America, home to five

> "While the world's resources are certainly limited, highlighting the link between climate change and fertility rates in poor countries fails to confront the deep systemic issues that have driven mass ecological damage."

percent of the world's population, is responsible for 18 percent of carbon emissions. On the other hand, Africa – with 16 percent of the world's population – emits only four percent of the total carbon dioxide (CO_2). The top 10 richest countries in the world are responsible for 75 percent of the world's CO_2 emissions, and 100 countries emit just three percent.

COMFORTABLY NUMB

A (hypothetical) Joburg businessman wakes up in his Dainfern Townhouse and puts on a pot of coffee while he runs a shower. In the shower, which took a minute to get hot, he is spoilt for choice in shampoos and shower gels, all in plastic containers. He makes a mental note to buy a new shampoo only when the others are finished. Deep in thought of the business day ahead, he enjoys an eight minute shower. In the middle of the winter, he makes sure that his towels are on the heated towel rail, while his house is heated throughout. He chooses to wear an outfit he bought a few months back, but because his checked shirt is a 'fast fashion' item, it is already starting to fray. He makes a mental note to buy a new one on his way to the airport later that day.

His office in Sandton is 45 minutes from his house in a gated estate, and he gets into his SUV. He travels alone to work, stopping at a local drive-through ATM to withdraw some cash. He then drives to a fast food outlet and joins the long queue to order his meat-based breakfast and a grande latte in a non-recyclable cup. His breakfast comes with a plastic fidget toy, which he tosses out of the window.

At lunchtime, he orders lunch after forgetting to take his packed lunch in the morning. His wife often complains of having to throw out a fortune of expired food.

After a day's work, he heads on to the airport to fly to the US on a five city business tour. His wife and children will join him a few days later for a short holiday.

LIVING THE (HIGH RISK) LIFE

Two hours before our businessman hits his shower, his domestic worker has already been busy, getting her family ready for the start of their day. She has three children, with a fourth on the way. The businessman often chastises her for having too many children.

Upon waking in cramped accommodation in Alexandra township, Johannesburg, the woman prepares a simple breakfast of pap [mielie meal] on a gas stove. The night before, she collected water for washing and drinking from a local communal tap.

Ready to leave, the woman starts her 23km commute to Dainfern, where she works. It takes her two taxis and around two hours to get to work. Her children walk to the local school with their lunch tins. No food is wasted. Sometimes there is spare change for the children to buy sweets from the informal shop.

With nothing else to do at night, the whole family winds down in front of the television.

Being a conscientious person – he's actually labelled a "greenie" at work – the businessman decides to calculate his carbon footprint while waiting for his airplane meal. He is shocked to see that, should every person on the planet lead the same lifestyle as him, we would need 2.7 planets to support ourselves.

His family produced at least 13.80 metric tonnes of CO_2 per year, which is just under double the average footprint for people in South Africa (8.98 metric tons) and just under three times the global average (5 metric tons).

His domestic worker's family, on the other hand, produces just about the same amount of CO_2 per year as what is needed globally to combat climate change, at 2,07 metric tonnes per year (worldwide target is 2 metric tonnes). If each person on earth lived the same lifestyle as her family, we would need just one planet to sustain ourselves.

If our Dainfern businessman lived in Texas, in the United States, things would have been much worse. According to Our World in Data, an average African's carbon emissions is 17 times lower than the average American, with the average African's carbon footprint coming in at 0,3 metric tonnes and the average American being responsible for 19,8 metric tonnes.

REMOVING THE BEAM FROM ONE'S EYE

Professor Matthew Chersich of the Wits Reproductive Health and HIV Institute, says countries with low fertility rates are those which emit the most amount of carbon dioxide owing to their lifestyles. The WWF has said that if everyone lived like an average resident of the USA, "a total of four earths would be required to regenerate humanity's annual demand on nature".

"By using poor people's family sizes as a scapegoat, wealthier people feel they don't need to alter their carbon-rich and consumerist lifestyle," he says.

Chersich acknowledges that unintended pregnancy can lead to mortality and morbidities, especially in poorer communities. Programmes to improve access to contraception and other family planning resources are a key health priority. Reducing the population number in poorer settings will lower the nutritional consequences of climate change and increase the resources available to countering climate change impacts. "However, reducing unintended pregnancies in these settings will probably do little to prevent further greenhouse gases … and halt climate

change," he says.

As far as climate change is concerned, Chersich says family planning initiatives should be implemented in carbon-loving countries. "We should strongly encourage wealthy people to have as few children as possible. Each additional child means a whole lot more carbon dioxide and considerable harm to people elsewhere."

Manderson concurs that supporting women to have fewer children contributes to sustainable development, and food and water security.

It is critical to note, however, that climate change will affect demography more than demographic change will affect the climate. "Telling poorer people to have less children is a wonderful way to shift responsibility, given that the people who have the most children use the technologies that contribute to climate change the least," says Manderson.

CLIMATE INJUSTICE

Those who contribute the least to climate change – those in low to middle-income countries – will suffer the most from its effects. Richer countries (and people who live more comfortable lifestyles) should therefore focus less on the red herring that poorer countries with high populations contribute to climate change, and more on the idea that existing inequalities and poverty will only worsen on a warmer planet.

Jacklyn Cock, Professor Emerita in Sociology and Honorary Research Professor in the Society, Work and Politics Institute (SWOP) at Wits, has noted that the climate crisis is less about the "poor other" overpopulating and destroying the planet, and more about the outcome of an unjust global system, where so few reap the benefits of capitalism.

Cock believes that alleviating climate change begins with establishing "alternative social forms, institutions and practices outside of capitalism". These are mainly collective arrangements and mobilisation: bulk buying, decentralised, community-controlled forms of renewable energy, community food centres and seed sharing. In an article in *The Conversation*, Cock says: "The concept of environmental justice provides a radical alternative to the discourse of conservation, questioning the market's ability to bring about social or environmental sustainability. It affirms the value of all forms of life against the interests of the rich and powerful."

It is wealthy and educated people, Cock says, that have to change by consuming less and conserving more.

Indeed, activists from the global south should forge ahead with alternatives, lobby powerful fossil fuel interests and certainly impress upon countries in the global north to have fewer children to save the planet.

CALCULATE YOUR CARBON FOOTPRINT
https://www.carbonfootprint.com/calculator.aspx

CALCULATE YOUR ECOLOGICAL FOOTPRINT
http://ecologicalfootprint.com

CARBON FOOTPRINT PER YEAR

	DAINFERN FAMILY	ALEXANDRA FAMILY
Electricity	360kWH	72kWH
Gas	20 litre	20 litre
Flights	1 x Joburg to JFK (NY) 2 x Joburg to Cape Town	None
Car	SUV – 2 Litre diesel 15 000km	None
Taxi/Bus	None	11 040km
Food	R24000	R12000
Clothes	R7500	R1500
Books/ Magazines/ Newspapers	R750	R100
Phone	R7200	R2400
Bank/ Finance	R216000	None
School	R120000	R720
Recreation/ Sport	R4800	None
TOTAL CARBON FOOTPRINT	**13,8 metric tonnes**	**2,07 metric tonnes**
WORLD TARGET FOR CARBON FOOTPRINT	**2,0 metric tonne**	

TEENS FEEL THE HEAT OF CLIMATE CHANGE

DELIA DU TOIT LAUREN MULLIGAN

Climate change not only threatens mental health in South Africa, but also heralds poorer matric pass rates as teens, in particular, inherit the Earth.

In 2017, when the drought in Cape Town was at its worst in over a century, aid organisation Gift of the Givers made an urgent call to South Africans to help farmers; suicide rates, amongst both small- and large-scale farmers, had surged in the few months prior. This and other evidence paints a bleak future picture in the context of climate change, and southern Africa is one of the areas that will suffer the most.

ADOLESCENT MOODY BLUES

So say Professor Matthew Chersich and Dr Fiona Scorgie in the Wits Reproductive Health and HIV Institute (Wits RHI), who have been studying the effects of climate change on adolescents. "Today's youth will inherit a world made hazardous by greenhouse gases. The world's temperature has already risen by 1°C above pre-industrial levels and, without major intervention, will rise a further 0.5°C by 2040. Heat waves and other extreme weather events have become frequent and intense. In southern Africa, temperatures are expected to rise at twice the global rate, creating virtually intolerable conditions for people in settings where buildings are poorly insulated and ventilated," says Scorgie.

The effects are so severe, in fact, that Chersich predicts an increase in violence, mental health disorders, and suicide, as well as poorer matric pass rates, if nothing is done. "Exposure to high temperatures alters one's physiology, raising anxiety, depressive symptoms, irritability and aggression. People feel powerless when they have no means of keeping cool, when they can neither fight nor flee the hot weather. The effects will be most pronounced amongst those who can't afford air conditioning and we have no idea how communities who are not acclimatised to high temperatures will cope with several days of 40 plus degrees in houses with tin walls and roofs, zero insulation, and no cold water."

DIMINISHING THE BRIGHT SPARKS

And when learners have to write matric in overcrowded and stuffy prefabricated or shipping container-classrooms in hot weather, even the smartest will struggle, he says. In *Climate change and adolescents in South Africa: The role of youth activism and the health sector in safeguarding adolescents' health and education,* published in August 2019 *in the South African Medical Journal*, Chersich, lead author, says that while the Department of Basic Education mentions environmental factors such as ventilation and the hazards of non-brick structures in its school infrastructure standards, these have not yet been fully actualised.

"In many schools, classrooms are made of converted shipping containers or prefabricated sheeting with corrugated iron roofs. Most container classrooms have poor insulation, little natural ventilation and as many as 50 children in a class, who themselves generate a considerable heat load. In one study in Johannesburg, which has a relatively mild climate, temperatures reached as high as 47.5°C in the containers and the majority of students reported experiencing heat-health symptoms every day, including drowsiness, poor concentration and thirst."

And even at much lower temperatures, the effects are profound. A meta-analysis of 18 studies calculated that students in classrooms with an indoor temperature of 30°C scored 20 percent lower on tests than those in classes around 20°C. "The performance of adolescents appears to be more heat sensitive than the performance of adults in occupational settings. Nevertheless, teachers exposed to high temperatures may also become lethargic and irritable. In classes with poor ventilation, levels of CO^2 or stuffiness rise together with temperature, and children experience symptoms that further affect concentration and learning," writes Chersich.

"Exposure to high temperatures alters one's physiology, raising anxiety, depressive symptoms, irritability and aggression."

A PSYCHOLOGY OF SUSTAINABILITY

Professor Andrew Thatcher, Chair in Industrial and Organisational Psychology at Wits, is currently researching the psychological factors around the adoption of sustainable technologies. So-called green buildings can increase productivity, he says. "For our research, we looked at close to 20 buildings. Each of them was given an indoor environmental quality (IEQ) score out of 27 as determined by the Green Building Council of South Africa's green building rating tool [GreenStar SA], which takes into account air quality, ventilation and ventilation rates, ambient temperature, noise and lighting. It's incredibly difficult to get a perfect IEQ score, but those at the top end, with a score of 22-23 points, had productivity gains of 17%, which would translate to enormous improvements in large corporations, for example."

And the solutions offered by IEQ principles aren't restricted to corporate budgets. In container classrooms, simple adjustments could already make a difference, says Thatcher. "Orienting the container to avoid direct sunlight will help or placing it next to a tree for shade. A deciduous tree that offers shade in summer and loses its leaves in winter to let the sun in would also be a helpful solution in colder climates."

FRESH AIR AND FLIP-FLOPS

Adding windows, he says, could make a crucial difference, referencing a Californian study. "The researchers hypothesised that daylight is an important component in classrooms. They measured performance in two southern Californian classrooms – one with big windows, one with small windows – and found that the kids with the bigger windows fared better, confirming [the researchers'] beliefs. But when they repeated the experiment in northern California, where it's cooler, big windows made no difference. It turned out that daylight didn't play a role in performance, but fresh air did – the classes in warmer southern California had their windows open."

Scorgie and Chersich are awaiting funding to conduct a study measuring these and other impacts in South Africa, and to investigate how exposure to ambient heat impacts children's health, wellbeing and educational achievement. "We will test whether these impacts – such as dehydration, heat exhaustion, lethargy and poor concentration – can be reduced by using low-cost, low-electricity cooling methods, including natural ventilation, the installation of fans on classroom walls, painting the classroom roof white, placing plants and cold water dispensers in the classroom, and wearing sandals and loose, single-layered, cotton clothing," says Scorgie.

These measures could inform policy to mitigate climate change, says Chersich. "There is much that can be done using low-cost interventions and little electricity. We urgently need sensible public health initiatives and ground-up activism to start to undo the effects already occurring."

SUNNY-SIDE UP AS WITS GOES GREEN

Universities breaking new ground in climate research should be models of sustainability themselves. At Wits, initiatives to mitigate global change are taking root.

BUHLE ZUMA 📷 SHIVAN PARUSNATH

The Greening Universities Toolkit by the United Nations Environment Programme notes that:

"Worldwide, universities teach, conduct research, and contribute to the global knowledge base across every aspect of sustainability … Yet when it comes to the university's own fabric and operations, there is frequently a significant disconnect."

Indeed, the number of universities participating in the *THE World University Rankings 2019 by Sustainable Development Goal (SDG): Climate Action* is far fewer than those in global academic rankings. There's generally also less fanfare in the media about the SDG ranking and it is less scrutinised by alumni, students and the public.

Wits is taking a holistic approach to greening its operations in line with the 2030 SDGs, the agenda of which has 17 overlapping goals relevant to the University. Operationally, this includes infrastructure management (grounds and buildings), energy, waste, water and transport.

LIGHTBULB MOMENTS

An aerial photograph of campus reflects initiatives underway to manage the University's carbon footprint – many buildings on Braamfontein Campus West are equipped with solar technology systems that produce electricity and heat water. In 2017, Wits' first photovoltaic system (solar panels), which primarily supports office requirements such as lights, office and laboratory equipment, was installed. Many offices are now fitted with motion sensing lights, which prolong the working life of the light bulbs and thus reduce replacement costs.

"The energy efficiency programme and associated projects targeted at power generation and electricity savings began three years ago," says Jason Huang, Planning and Development Manager at Wits, whose long-term goal is to "take Wits properties off-grid" and be independent of Eskom or City Power.

Creamer Media's Engineering News

"It is the largest solar thermal hot water system in the southern hemisphere that combines various alternative energies for large residential areas and a model for other institutions."

ALTERNATIVE ENERGY JUNCTION

An ambitious pilot project at Wits Junction aimed to install a system with enough power to meet the hot water demands of the residence complex, which houses 1 100 students in 14 buildings. However, there were constant interruptions to the hot water supply during the pilot. This prompted Wits to collaborate with the South African Solar Thermal Training and Demonstration Initiative (Soltrain).

The new system, introduced in 2018, combines solar, cogeneration and gas heating technologies and has proved to be more stable. It is the largest solar thermal hot water system in the southern hemisphere that combines various alternative energies for large residential areas, and a model for other institutions. Huang and his team won the Sustainability Award from the Higher Education Facilities Management Association for this innovation, which has since been rolled out in Wits' David Webster and Barnato Residences on Braamfontein Campus West.

"The system has sufficient hot water generation capacity. The next step for us is to address student consumption, which is approximately 80 to 100 litres per day. This is far higher than the 50 litres a day of the average South African," says Huang, highlighting the more challenging behavioural changes that must accompany sustainability initiatives.

GREEN OPERATIONS

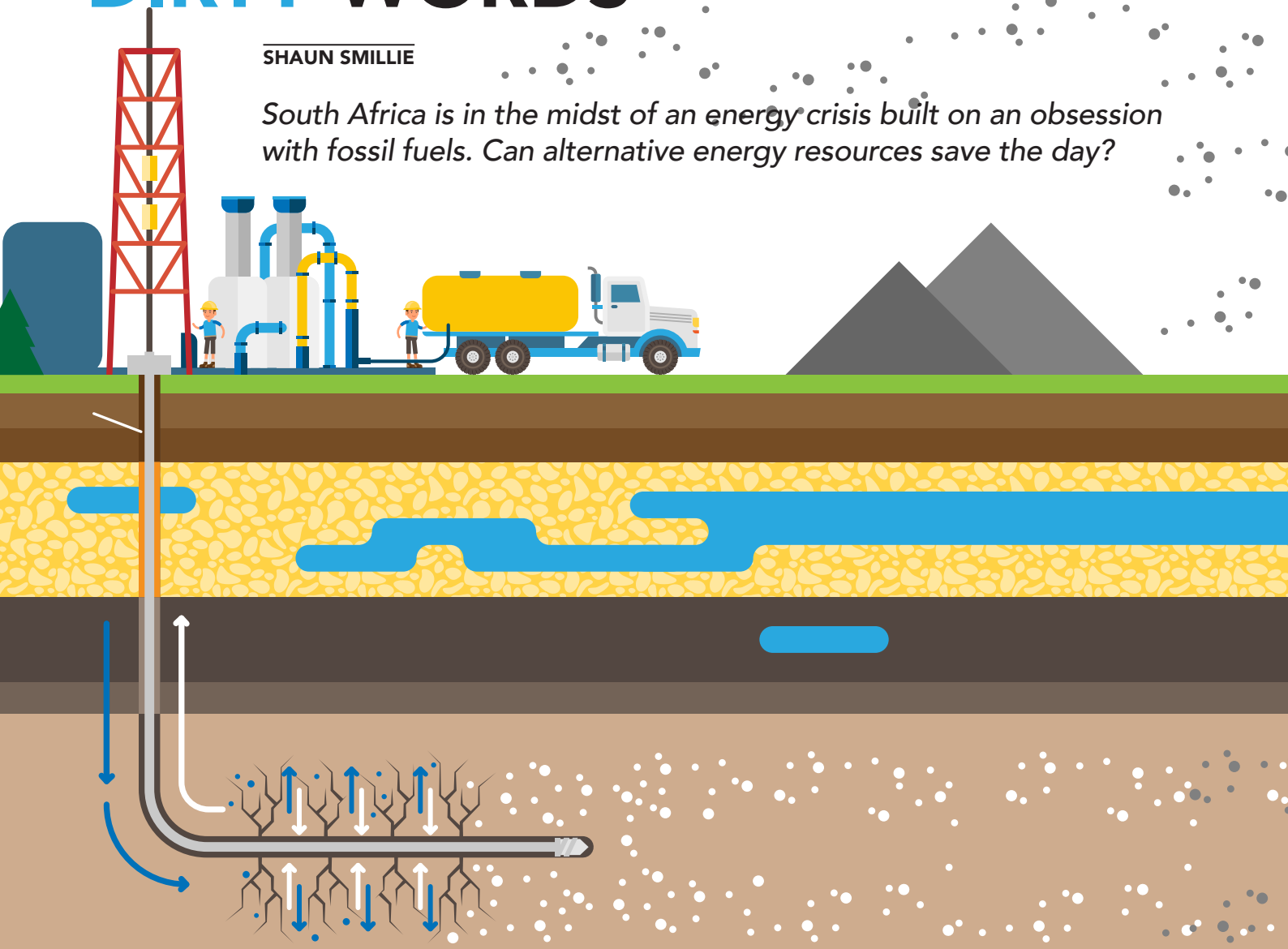
Head of Wits Services, Israel Mogomotsi, is looking at the entire value chain. Key divisions include Transport and Fleet Management; Cleaning and Hygiene; Wits' Rural Campus; Printing and Mailing; the Professional Development Hub; Retail Operations Management; and dining halls. All these divisions are crucial to resource management and environmental sustainability:

- Supplier contracts emphasise environmental sustainability from those who provide cleaning chemicals, to machine and catering suppliers.
- Recycling on campus is set to be revived and colourful recycling bins have been distributed to promote separating at source.
- The fully operational recycling station established early in the 2000s, which faltered in 2017 when external service providers were phased-out due to insourcing, will resume in 2020.
- The new garden policy promotes the planting of indigenous flowers and plants. Wits has two major roof gardens – on the Hillman Building and the Oppenheimer Life Sciences building – which makes them energy efficient. The gardens insulate the building in winter and keep the heat out in summer.
- Bicycle and carpooling strategies are being explored as alternatives to cars. Aside from the carbon emissions, there is a shortage of parking for cars and Wits' 3 000 parking bays consume land.
- There are seven food gardens on campus supplying the Wits Food Programme, which provides a hot meal to students in need. Furthermore, members of the Citizenship and Community Outreach Programme have established a food garden at the Yeoville Community School, and another is on the cards for Trinity Church, which runs a soup kitchen for the homeless in Braamfontein.

FINDING ALTERNATIVES TO OUR FAVOURITE DIRTY WORDS

SHAUN SMILLIE

South Africa is in the midst of an energy crisis built on an obsession with fossil fuels. Can alternative energy resources save the day?



For a long time in South Africa's energy sector, coal was king, responsible for heavy lifting the country into the industrial age with its offering of cheap, reliable and abundant energy.

But in a post-industrial world, coal has become the black sheep, as cheaper and greener energy sources are becoming available.

South Africa still has a long way to go before it is weaned off coal fully as the main source of energy, if the state has its way, but private enterprise and the forces of economics might have the final say in the way that we generate energy in the near future.

THAT DESPICABLE, DARK "L" WORD

In mid-October, while the country was in the grips of a week of loadshedding, the government released its Integrated Resource Plan (IRP2019). The plan mapped out what South Africa's energy generation mix would be for 2030.

Coal will still play a major role in South Africa's energy future, contributing 58% of South Africa's energy needs.

The balance of 20.4 gigawatts worth of electricity will come from renewable energy sources in the form of wind, solar, and hydroelectric power, with wind contributing 18% of the country's electricity.

The problem with coal headlining the IRP2019 plan, says Bob Scholes, Professor in Systems Ecology at the Global Change Institute at Wits, is that it is no longer cost effective.

"People keep on going on about South Africa having a world class coal resource, but it is no longer true. We have picked out the juicy bits and from here on out, our coal resource is of low quality or very difficult to extract," he explains.

"We have a much more world-class solar resource. Actually, new coal build is coming out twice as expensive as new solar or wind. So why choose a technology that is twice as expensive?"

Scholes adds that today whole countries are being run on renewables.

"It was always thought to be impossible. But now the

battery technologies and smart grid technologies are so good you can essentially run any economy in the world entirely off renewables."

THAT UGLY "F" WORD

What is not in this energy mix proposed by government is something that, a few years ago, promised to be a saviour of the country's economy. The highly emotive debate on hydraulic fracturing of gas shales, or fracking, has since died a quiet death.

Fracking changed the energy landscape of the US. Over the last decade the US has increased its oil production, and in 2012 it overtook Russia as the leading gas producer, all thanks to fracking. In South Africa, the Karoo was speculated to contain shale gas reserves of hundreds of trillions of cubic feet. Talk of fracking in the Karoo ignited a heated debate on whether this should be allowed in this fragile environment.

Scholes co-led the strategic environmental assessment of shale gas development for the Department of Environmental Affairs. They discovered that developing the Karoo shale gas resource was not economically viable when considering today's energy prices. The main reason for this is the geological make-up of the Karoo.

"The fundamental reason is that horizontal drilling works just fine in the shale gas beds of the United States. They are horizontal beds of great extent," says Scholes.

"The problem in South Africa is that we can't drill for several kilometres horizontally, because you bump into a dolerite dyke. The distance we can go horizontally is not enough to make it economically viable, given the characteristics of the gas present."

There are more conventional gas reserves available in South Africa. Included in this is the newly discovered Brulpadda field located 175km off Mossel Bay. It holds promise, but is not the sole solution to our energy challenges, says Scholes.

"That is a resource of significant size, equivalent to two years of South African energy use. It is substantial, but not manna from heaven."

As the government is searching for solutions to the country's energy problems, the private sector is already taking advantage of new green technologies, as it looks for a more reliable and cheaper alternative to Eskom. Home owners, for example, are taking advantage of increasingly cheaper solar panels and are moving off the grid.

THAT DIRTY "C" WORD – CLEANED UP

But the private sector can benefit further from alternative technologies that would make them independent of large utilities such as Eskom. Professor Thokozani Majozi in the Wits School of Chemical and Metallurgical Engineering and his team are advising industry on using waste heat to power electrical needs. Industries such as petrochemicals, food and beverage, pulp and paper, and the chemical sector all have waste steam at their disposal that could be run through a turbine to generate electricity. This steam is usually generated by coal.

"Coal is here to stay, but we need to think differently about how we use it," says Majozi.

The poster child of generating steam for electricity is petrochemicals giant Sasol.

"A company like Sasol generates one gigawatt on site and the other gigawatt it will get from the grid," explains Majozi. If Sasol had to source both gigawatts, it would mean the company would be drawing nearly 5% of the power available on the national grid.

> "The Congo river could produce more energy than we could ever use"

"If you are saving one gigawatt, that is equivalent to about 10 000 houses in a big suburb," says Majozi. "It is a major impact."

THE "B" WORD TO SAVE THE DAY?

Biofuels are another alternative source being used effectively in countries like Brazil.

Biofuels are produced from living matter. South Africa has a lot of waste material that lends itself to use as biofuels.

The problem with biofuels, however, is that there is still so much to be learnt about them, and how energy from biofuels can be made more efficient, says Michael Daramola an Associate Professor in Wits' School of Chemical and Metallurgical Engineering.

Daramola and his students are working on converting animal fat into biodiesel, using a catalyst developed from another South African waste material – animal fat.

"The animal fat from the slaughter slabs end up in landfills. It decays in the landfills and causes a lot of environmental problems," says Daramola.

However, biodiesel is often difficult to use in colder environments because of poor flow performance. To solve this problem, additives have to be added, which, due to a lack of research in this field, often comes up to guess work, says post-doctoral fellow, Dr Cara Slabbert.

Together with Professor Andreas Lemmerer in Wits' School of Chemistry, Slabbert has been working on improving the qualities of biodiesel.

The duo discovered that by shortening the carbon chains of fatty acid methyl esters, they could reduce the melting point of biodiesel significantly, making the fuel much more user-friendly.

"The next step I would think is to try it. We would need to find out if it is viable for use in a vehicle," says Slabbert.

HOW ABOUT THE "H" BOMB?

Whatever the future of South Africa's energy mix in the next 10 years, Scholes sees no place for fossil fuels like coal.

"We will have to replace our generation capacity in approximately the next decade. Why will we replace it with more of the same?"

There are other renewable power sources on the horizon, which if tapped properly, will provide huge energy resources for not only South Africa, but for the rest of Africa.

Near the port of Matadi in the Democratic Republic of the Congo, a sharp bend in the mighty Congo river squeezes the river into a gorge that is just 250m wide.

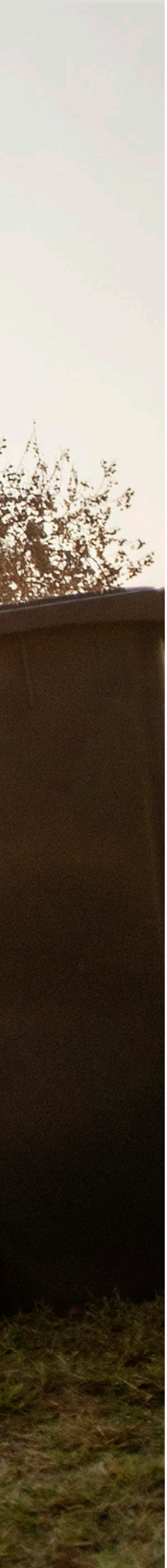
This is the site of the grand Inga dam, which could in future be the largest hydroelectric project in the world.

"The Congo river could produce more energy than we could ever use," says Scholes. "But the problem is how do we get it from there to here and the main constrain on that is not an engineering one, it is a political security constraint."

THE WAR ON WASTE PICKERS

The waste pickers of South Africa are critical to the recycling economy and to the country's green future, yet they are marginalised, maligned, and discarded.

TAMSIN OXFORD 📷 DANIEL BORN



The man in the tattered shirt, biceps bulging as he pulls an enormous bag of waste behind him on a trolley. The blaring horns as cars slide by, annoyed at the intrusion in their lane. The furtive WhatsApp messages on community channels, "Are these waste pickers dangerous? I don't like them digging through my trash …"

These are the responses that marginalise a community that has grown out of discarded waste, the dumpster, and the landfill site – reclaimers, or waste pickers, are people with extraordinary expertise that have saved the government up to R748 million in landfill airspace and put South Africa's recycling economy on par with Europe.

THE INVISIBLE VITAL

"The reclaimers collect around 80 to 90 percent of all post-consumer packaging and paper left behind. If they stopped tomorrow, there would be no recycling industry in South Africa," says Dr Melanie Samson, a Senior Lecturer in Human Geography in the School of Geography, Archaeology and Environmental Studies at Wits.

"They are the unseen but essential connection between the waste management system and the economy and they're subsidising the entire thing. They're not being paid for the work that they do, only a very small portion of the sale price on the recyclables they collect. Considering how much money they save government, they are performing a critical role and yet they are largely stigmatised and harassed and not seen as people."

SKILLED CITY SURFERS

Samson began researching waste reclaimers in the early 2000s, initially focusing on gender, race, and the privatisation of waste management. In 2008, she started working with waste reclaimers in South Africa and globally, expanding her research to focus on forms of dispossession and inclusion. For Samson, the waste pickers have stepped into a gap left behind by a lazy population that doesn't separate at source (SAS) and the waste pickers have created an entire recycling economy built on their expertise.

"People think of them as crazy, poor, dirty and uneducated people who scramble through the trash to eke out a living," she says. "We need to change this perception. They are not marginal and they do not need to be eradicated. We are not the experts, they are. Refusing to acknowledge their skills and ingenuity is a form of colonial thinking that has to change."

RECLAIMING PARTICIPATION

With a team of 16 graduate and postgraduate students, Samson has conducted in-depth research into what waste picker integration would mean for residents, officials and the pickers themselves. The data will inform national guidelines for a system to integrate and empower waste pickers. The team collaborates with reclaimers directly to generate information about the contributions they make and the work that they do.

"Conversations about waste picker integration have always been about helping reclaimers to integrate their unpaid labour into a new, formal municipal recycling system," says Samson. "I turned this on its head and asked: How can government and industry integrate into the fantastic, well-functioning, SAS system that the waste reclaimers have already created? We need to recognise and build on what they have done, there's no reason to start from scratch."

> "Waste pickers are people with extraordinary expertise that have saved the government up to R748 million in landfill airspace and put South Africa's recycling economy on par with Europe."

The national guidelines are focused on what already exists within the recycling economy and how these can be effectively integrated into a more formal system. Analyses of what's happening on the ground by Samson and her team enable the development of a participatory regulatory policy in collaboration with the waste pickers themselves.

CAPITALIST EXPLOITATION

"Governments don't pay attention to these informal economies, often going in to situations like this and acting as if there's no system already in place, creating new systems with private companies. Nobody recognises the impact that this has on the waste reclaimers and their lives. These people do so much and yet they are deeply and profoundly exploited," says Samson.

When government contracts private companies to take on the SAS role, the income of the waste pickers can decrease by more than a third. They end up living in parks and waking at 3am just to beat the trucks. Not only does privatisation impact their quality of life, it also doesn't work – when private companies take on the role, recycling levels drop because these companies are paid a fixed rate per household, whether or not they collect the waste. It just costs the government money and the waste pickers their dignity.

"If we focus on what the waste pickers already know then we can build a better understanding of our recycling economy and change their lives," says Samson. "They are skilled knowledge-workers who separate our materials for us and the city. They turn our rubbish into a thriving recycling economy, which begs the question – who really are the dirty ones?"

GREEN IS THE NEW BLACK

SHAUN SMILLIE FRANK KIENHOFER

In our bid to save the planet from catastrophe, we have entered "the age of green". There are green cars powered by green energy and now kept on the road by green tyres.

Green cars and green energy are not new. Very few conversations go by without someone mentioning green variations of energy. However, there's a new kid on the block, one that new research has proven could drastically limit the CO_2 emissions from our cars, while saving you cash in terms of fuel consumption.

In November, two trucks did lap after lap around a track at the Gerotek Test Facilities in Pretoria. One of these trucks was driving on conventional tyres, the other was fitted with a brand new set of "green" low rolling resistance tyres.

(LOW) ROLLING IN THE GREEN

As each vehicle was kept to a steady speed of 80km/h, researchers carefully monitored a number of datasets – including fuel efficiency – coming from the vehicles. Every two hours, the drivers would take a 10-20 minute break.

"The problem that tyre companies have is that they have found it difficult to get the green truck tyre accepted in the industry because fuel consumption is dependent on so many variables," says Professor Frank Kienhöfer in the Wits School of Mechanical, Industrial and Aeronautical Engineering. "You look at the driver, the wind speed, and the vehicle. All of this means that tyre companies are struggling to pinpoint that tyres can make a fuel saving difference."

Working under the umbrella of the Centre for Sustainable Road Freight South Africa, the research team, which included members from Michelin, Iveco, Afrit, Lafarge, and Total, with research institutions Wits, Cambridge University, and the Centre for Scientific and Industrial Research, set out to establish whether green tyres actually make a difference, by setting up a highly controlled test environment.

TYRES ON TRIAL

The trials, over a year in the making, were set up by Wits researchers, who were in charge of everything from booking the test track, to setting up the test protocols.

"What makes the low rolling resistance tyres different is the materials are slightly different, they have silica instead of carbon black and the tread is different," says Kienhöfer.

"There is less energy being wasted in terms of turning the tyre and that manifests in low temperature." They are considered as safe as conventional tyres.

Once the team started looking at the results, they were pleasantly surprised. They found that, at 80 km/h, the long haul truck burnt eight percent less fuel on green tyres than on ordinary tyres. This means eight percent less CO_2 was emitted into the atmosphere from a single truck. Multiply that by all the trucks on our roads, it could make a significant difference.

"We were thinking the difference would be more in the ball park of 5 to 6%," says Rehaan Abdulla, a Wits MSc student involved in the study. "So there appears to be massive advantages of using the rolling low resistance tyres."

Even though green tyres have a 25% shorter life-span than their traditional counterparts, they still hold the edge when it comes to financial benefits to transport companies. Kienhöfer points out that such savings on fuel could increase profits by 40%, even when calculating in the tyres' shorter life-span.

CLEAN CAREERS AND GREENER PASTURES

The green economy could save South Africa in more ways than one – cleaning up the environment will contribute to the economy, too.

LEM CHETTY

One expects solutions to environmental climate crises to be found in the lofty realms of academia, activism, laboratories or engineering and, although these skills are important, there are answers closer to you and me. So says Dr Presha Ramsarup in the Centre for Researching Education and Labour in the Wits School of Education, who created the Green Skills Project for South Africa.

While designing the Green Skills project as part of South Africa's first Environmental Sector Skills Plan, Ramsarup's research revealed that, at an occupational level, green jobs don't have to start from scratch but can be an adaptation of just about every current process of work. Furthermore, and in keeping with the purpose of green jobs, which are not only careers in the environmental sustainability sector, but any career which can be transformed a sustainable way, the green economy starts on the ground.

FRESHLY MINTED OLD JOBS

"Originally there was a focus on technological change in transition to a greener economy, but what we're after is a just, sustainable solution. It is a triangular solution of working greener – in an ecological, economic, and social way. In creating a plan for development of this economy, we had to ask how green jobs can achieve this triangle of elements," she says.

So there will be the scientists who look for green solutions, and Chief Sustainability Officers within corporates to determine social impact, wind energy farmers to find sustainable energy solutions. However, green jobs also require everyone to focus on the green aspect of their work – energy-focused auditors and engineers, writers and teachers, bakers and more. The informal sector, particularly in South Africa, will continue with the work of waste pickers and sorters, recyclers and market gardeners.

"We had to look at what the jobs could be that would enable people to enter the community, change the products and process of work, so that they answer the bigger questions about social justice and society, in addition to the ecological question. We are looking at new streams of work and how they can help local communities. This type of work is about sustainability that is moving beyond science and technology," she says.

DEFINING THE GREEN ECONOMY

To begin the process of greening the economy – which refers to transforming current economic activity in a sustainable way – we must start reskilling with a green eye, so to speak. Green-skilling can begin at school and tertiary level, although postgraduate skills include analysis, planning and development. These can be adapted to take care of South Africa's water, waste, clean energy and biodiversity, according to Ramsarup's brief for the Environmental Sector Skills Plan commissioned by the government.

Greening includes reshaping the "blue" economy too, which looks at the oceans and coastlines, which are vast in South Africa. The skills and human capacity required to effectively manage, protect and utilise the resources in and around these areas are often highly specialised and scarce.

"Knowledge of marine ecosystems and their inter-connectedness with continents and global systems is essential. Additionally, there is a great need for localised expertise to work along the coasts, as well as off-shore," says Ramsarup.

For waste water treatment works alone, green skills span engineering, sustainable farming, catchment management, business analysis, investment and economic planning, procurement, marketing and communications, air quality inspection, health and safety monitoring, teaching and more.

GREEN LEARNING BY SECTOR

Ramsarup says the environmental sustainability sector is currently unregulated, despite its size possibly being on the same scale as mining. "There is no Seta [Sector Education and Training Authority] for instance, around the green economy, so part of our research focuses on change-orientated learning pathways and sustainable development. It includes understanding the educational needs around greening in different sectors," she says.

She is currently researching the paint, agriculture, paper, public procurement, coal, mining and automotive industries. "The idea is that green jobs are not a homogeneous concept [within the sustainability area], but they should resonate within the South African working system and how to strengthen them through the integration of green skills."

Conceptualising and skills planning green jobs could take a decade, Ramsarup estimates but, for now, the focus is on greening the current landscape.

"It is about envisaging the work and reimagining it, whether it is from a production process or not. Where are the environmental hot spots in the chain? We can first address those needs with the knowledge we have and turn them around in a more environmentally-friendly way," she says.

NEVER LET A GOOD CRISIS GO TO WASTE

UFRIEDA HO

Although we are facing a global climate challenge, there are hidden benefits and opportunities if we respond to this challenge sooner rather than later.

Gallo images

Climate change can't be sugar-coated. It is the crisis of our time. But a crisis need not mean certain doom. We have an opportunity to think, plan and act for a world that will be changed, but which perhaps can be saved from being burnt to a crisp.

Professor Ivor Sarakinsky in the Wits School of Governance says change starts with transforming governance. Governance in a time of climate change demands a shake-up, he says.

"The governance debate in an era of climate change is about the idea of custodianship and the idea of co-production."

Custodianship is less fixated on governance as a tick-box exercise for the likes of transparency, accountability and responsibility and more about facilitating learning, adapting and breaking down of bureaucracies and silos, so there are enabled environments for co-production.

Co-production brings more people into problem solving and leans on the other '3Cs' that are considered the essential skills of the 21st Century: creativity, communication and critical thinking.

Custodianship doesn't pander to "green orthodoxy, the gold rush of the green economy, fake news by denialists and even green political point scoring," he says.

SEEING THE BLIND SPOTS

In South Africa, Sarakinsky believes, we have a number of opportunities to find solutions, such as reviving rail infrastructure to help reduce our reliance on road freight with its huge demand for fossil fuels; incentivising petrochemical industries to look at carbon capture and storage as beneficiated businesses; and even recycling used cement – a carbon intense commodity – instead of dumping it on landfills.

New business potential could also be sparked by lowering tariffs on imported electric vehicles and developing local industry to service and assemble electric motor cars. The same could be done with supporting the introduction of a smart-grid system where every household is a potential energy supplier and trader from solar photo voltaic systems (PVs) on their roofs.

"Even Wits should be thinking about how we go off grid, at least during the day, and become an example of how to be a sustainable, eco-friendly university," he says. Interventions could include PVs on rooftops and carports; rain harvesting systems; urban food gardening; and greater awareness in our personal responsibility to change habits and behaviours.

Where it comes to climate change, transformed governance looks at context and nuance. Sarakinsky says the goal is not to challenge the clear evidence from the science, but to see the blind spots, weigh up the costs and benefits of risks and interventions better, and factor in environmental impact assessments.

For example, Sarakinsky says, while being a big win for producing clean electricity from a renewable resource, PV systems have a dirtier side too. They are energy and water-intensive to produce and are made with toxic chemicals. They also have a limited lifespan of around 20 years, meaning that in decades to come they could end up in landfills as a toxic burden if they are not properly recycled.

Wind turbines are another clean energy producer, but wind farms can result in habitat destruction and can disturb ecosystems as their rotor blades are known to kill birds and bats in large numbers.

Various policies and targets that are designed with the best intentions in mind can also turn out to be ineffective or poorly thought-through. Carbon tax, for example, has not gone far

> "The Paris Agreement has no legally binding responsibilities or accountability mechanisms"

enough to penalise people for buying fossil-fuel guzzling cars or in curbing our reliance on air travel. "If you can afford it you'll just keep consuming or buying a big vehicle," says Sarakinsky.

Global carbon credit trading has also had limitations when these schemes are not set up as sustainable partnerships. Sarakinsky points to the case of some Spekboom farming initiatives in the Eastern Cape. The Spekboom is an indigenous succulent and is known to be excellent in sequestrating high amounts of carbon dioxide. They are water efficient and help to combat desertification.

Farming Spekboom for carbon credit trading held the promise of job creation, community upliftment and fighting greenhouse gases, but as carbon trading ended as per the Kyoto Protocol, these projects folded.

THE TIPPING POINT

It is going to be especially vital for the southern African region to think smart and act locally against climate change says Professor Francois Engelbrecht of Wits' Global Change Institute (GCI).

The region is at risk to reach what he refers to as a "tipping point" in the climate crisis. This will result in more multi-year droughts and intense heat waves that will manifest in issues such as food and water insecurity, deepening migration and displacement and economic strain in many sectors, according to Engelbrecht.

"Under the Paris Agreement [signed in 2016] it is clear that in order to avoid the most dangerous aspects of climate change, investments should be focused on the renewable forms of energy," says Engelbrecht.

"The country needs to formulate a clear plan of how it will systematically replace its coal-fired plants with alternative forms of energy, through a just transition process that does not leave anybody behind. Such a just transition will also imply significant international funding support and investments."

President Cyril Ramaphosa's submission to the United Nations Climate Action Summit this September got the thumbs up from Engelbrecht, who calls it "an important ray of hope". The submission outlines a vision of how South Africa can replace its dependency on coal with renewable forms of energy, through a US$11 billion just transition programme.

"If this vision can be realised, it would be the largest climate change mitigation project to be funded internationally," he says.

Engelbrecht, who contributed to a study led by a team of international scientists and published in *Science*, entitled *The human imperative of stabilising global climate change at 1.5°C*, believes bold steps will be essential. In the *Science* study, the authors argue that prompt investment in the next few decades is vital to mitigate the costs of future damages.

"The investment required in the energy sector in order to make the transition from fossil fuels to alternative forms of energy, as required to restrict global warming to 1.5°C, is estimated

to be in the order of US$100 trillion by 2050. Although this is a staggering number, the benefits from damages that may be avoided by 2200 are estimated to exceed this number by a factor of five."

WAVERING AGREEMENTS

However, the non-binding nature of international agreements on climate action make submissions such as Ramaphosa's too flimsy to hold real promise of action or change, says Professor Patrick Bond, in the Wits School of Governance.

"Ramaphosa's commitments to the UN came after South Africa was prevented from speaking in the main conference, due to the government's climate negligence," says Bond. "That was a well-deserved name-and-shame, exposing Eskom's commitment to the corrupt, mal-designed Medupi and Kusile coal-fired power plants – the world's largest such generators under construction – as well as three new ones, including a 4600MW Chinese project at the Musina-Makhado Special Economic Zone, as well as intensifying offshore drilling for oil and gas from Durban to Hermanus, the KZN and Karoo fracking projects, and the planned export of 18 billion tonnes of coal through Richards Bay," says Bond. He adds: "The Paris Agreement has no legally binding responsibilities or accountability mechanisms; inadequate stated aspirations for lowering global temperatures; no liabilities for past greenhouse gas emissions; renewed opportunities to game the emissions-reduction system through state-subsidised carbon trading and offsets; and a total neglect of emissions from military, maritime, and aviation sources."

He also warns that mainstream environmentalism is being co-opted by quick-fix fantasies, including biotechnology based on genetic modification, dangerous geo-engineering strategies (see page 42) and especially emissions trading, where South Africa's pioneer project at a Durban landfill collapsed financially, due to a decade-long world carbon market crash that began in 2008.

While emissions-trade supporters believe that a "market solution can solve a market problem", the carbon market is a "financial casino", and once Brexit kicks in, the European market at the heart of the system could again collapse, says Bond.

UNIFYING ACTIVISM

In a country like South Africa, climate activists face severe contradictions. PhD candidate Mithika Mwenda and Bond write in their paper *African climate justice: Articulations and activism* that "while leftist trade unions increasingly propose radical versions of eco-socialism, they still defend carbon-intensive employment with an understandable desperation. A burgeoning youth and ecologically-aware middle-class feint towards climate justice, but their stamina has not been tested. The mainstream climate action scene remains predictably tame and unambitious".

Bond says NGO and civil society efforts remain fragmented and not enough international collaboration exists between these civil society bodies to exert the kind of pressure to disrupt the business-as-usual model. His ideal type of international movement that could U-turn states and corporates is the Treatment Action Campaign, which gained access to free HIV medicines and thus raised life expectancy in South Africa from 52 to 64 years over the past 15 years.

The intersection of complexities, contradictions and seemingly insurmountable challenges do make our climate crisis ever more explicit. And scary as it seems, now is not the moment to run; it is more the moment to act on former British Prime Minister Winston Churchill's words: "Never let a good crisis go to waste". C

READ MORE ON THIS RESEARCH:
Find the IPCC special report on Global Warming of 1.5° here: https://www.ipcc.ch/sr15/

THE SUBTLE ART OF BREAKING THE SILENCE

BETH AMATO 📷 DAYLIN PAUL

Underneath the smoke and concrete, artists invite us to respond to changing climates

What is one to do when climate calamity is sure to break apart our ecological and social fabric? The overwhelming, even Sisyphean, task of halting rising global temperatures in the next decade is enough for even the bravest soul to succumb to inertia and apathy.

Instead of demanding headlines and doom-laden forecasts, the conversation could be reframed, allowing people to feel they can contribute to a solution. Wits-affiliated artists, Daylin Paul, Hannelie Coetzee, and Myer Taub show that art is not merely a vehicle to create awareness, but a means to ignite imagination and collaborative action.

Indeed their so-called "climate art" asks the public to co-create ways to respond to climate change, exercising meaningful agency. By involving the public, their art shows that the most pressing human questions can be dealt with communally and across disciplines.

HYENAS IN THE GREAT HALL

Hannelie Coetzee's hyena sculptures, part of the Synanthrope series, displayed at the Origins Museum in 2018, and a feature of the Watershed series of public engagements hosted by Wits University, aimed to draw people's attention to the "unseen" yet critical ecological realms of Johannesburg.

Coetzee is currently completing her MSc at Wits' Global Change Institute, and environmental engineer Chris Brooker first mapped the city's ancient watershed, much of which has been concreted over. Then, Coetzee took her hyena sculptures (repurposed from wooden items, like old tennis rackets and crutches) and made them "walk" the watershed. A stop-frame animation captured the hyena's path, which cuts through Wits' Great Hall.

As part of her practice, Coetzee invites the public to walk with her as an immersive experience. People, she says, are not viewers of art, but participants in it. "People are often disconnected from their environments. But when they realise they are walking on an actual watershed, their perspective changes. They are shocked at how such a critical piece of the city's ecology is cut off. The part of the watershed they walked is now a concrete path."

Coetzee also noticed that many of the walkers (67 people) assumed the watershed implied that rivers run underneath the surface of the city, which is not the case. "By walking, people became more aware of how water-scarce Johannesburg is, and the implications of hotter weather and droughts," she says.

However, Coetzee doesn't believe in explicitly telling people to enact change. "It's about creating conversation, and gently nudging people to think about their immediate environment."

In addition, hyenas are "synanthropes", creatures which survive in spite of, and because of, human encroachment. Hyenas have adapted to the human environment and can navigate the city's greenbelt in search of food and water – 60km a day.

"Hyenas teach us a lesson in resilience. Humans have to learn to adapt to a rapidly changing environment too," says Coetzee. One of the first steps is to "re-root" into the earth and to be aware of how humans have altered the land. Ultimately, it is we who must learn from nature's patterns and intelligence.

WALKING THE SPRUIT

Johannesburg's vast road and highway networks, its poor spatial planning, its dilapidated pavements and the fear of crime has made the city hostile to walkers. Motorcars take precedence over people.

But artist Dr Myer Taub, Lecturer in the Wits School of Arts, noticed quite serendipitously the "hidden" walking routes in the city: those along the *spruits* (streams). A few years ago, Taub decided to be car-free, but soon realised how unwalkable Johannesburg was, and how getting somewhere, even relatively close by, usually required transportation.

However, when he walked along the city's spruit routes (such as the one that runs between Patterson Park and Ethel Gray Park in north-east Johannesburg), he found that he reached his desired destinations relatively quickly and easily. Taub felt safe walking in these green belts.

"The spruits, indeed many of the city's water assets, are invisible. We have built around them; locked them away. In doing so, we have disconnected from nature and forgotten how we can design our lives in tandem with nature," he says.

In *Traces of the Spruit*, Taub's art intervention at the Wits Watershed festival in 2018, he invited the public to walk with him along the spruits. "Some people decided not to join after all, because of safety issues, which speaks volumes about the perception of open spaces in Johannesburg," he says.

Unfortunately, the spruits are highly polluted. As part of *Traces of the Spruit*, Taub dressed up as a river rat to retrieve "treasure". He submerged himself in the water. Some months later, when Taub got sick with another condition, medical investigations found that the exposure to polluted water had compromised his health.

"The pollution and toxicity of the spruit speaks to the utter disconnection from the meaning and importance of water. Through embodied practice (walking and submersion in the water), awareness is raised and change could occur, but I don't explicitly push for that," says Taub.

BROKEN LAND

Photojournalist Daylin Paul's black and white exhibition *Broken Land*, which was shown at Wits Art Museum (WAM), highlights the devastating effects of South Africa's coal-burning power stations on human beings. Paul is the Ernest Cole 2017 award winner for *Broken Land*.

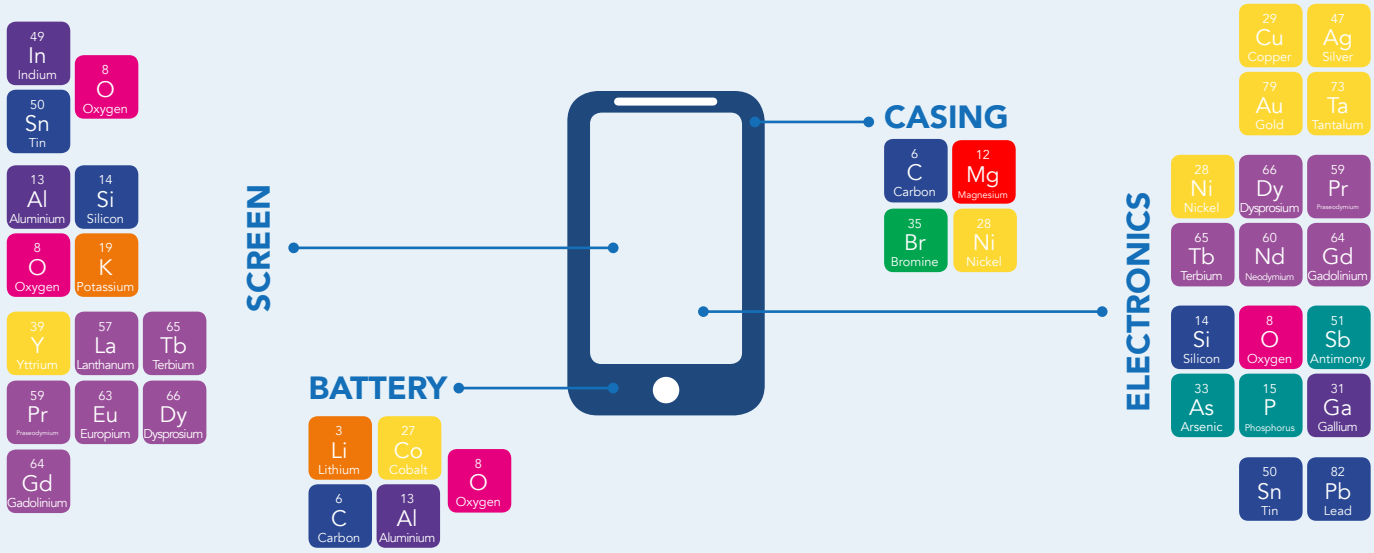
The contentious power stations built in Mpumalanga have polluted the land, the water and compromised the health of communities. Yet the country soldiers on with its fossil fuel industry goals despite the growing viability of cleaner energy sources to power the flailing economy.

Paul's haunting photos (pages 26 and 27) show the human and cultural toll: there are remains of a Ndebele village destroyed by the building of coal mines; toxic rivers; and the poverty right outside the imposing mines and power stations.

"The people whose lives are most affected by the burning of coal for electricity, are often those who have no access to electricity themselves."says Paul. He adds that it's easy to forget the human beings whose stories are more "beautiful and tragic than the landscape that mirrors their lives".

Paul's exhibition was profoundly disturbing. People felt shaken to the core when, at the opening of the exhibition at WAM, guest speaker and journalist Sipho Kings, noted that just having lights in the venue cost someone their life.

Paul's work speaks to climate justice: those who pollute the least are most affected by climate change and indiscriminate ecological and cultural destruction. His work is an overt indictment of all those who "sleepwalk ever closer to climate catastrophe". C



THE GREENBACKS IN MOBILE PHONE MINES

Consumer products rule our world. Period. And in our modern lives, electronic equipment is no longer a luxury – it is a necessity. No-one who is economically active can afford to go without at least a mobile phone, and at the pace that electronic equipment is re-invented, it's only a matter of time before your 'latest' iPhone 11 ends up on a dump site.

As fast as we produce electronic equipment, we produce electronic waste. In fact, according to a joint report by the Platform for Accelerating the Circular Economy (PACE) and several United Nations agencies under the umbrella of the E-waste Coalition, the world produces 50 million tonnes of electronic and electrical waste (e-waste) per year – this is more than the weight of all commercial airliners ever made.

And this electronic and electrical waste has a value of over US$62,5 billion.

MINE MOBILE, NOT EARTH

As the world's population creeps closer to 10 billion people on Earth by 2050, the amount of e-waste we generate increases concurrently. Although we're well on track to producing 120 million tonnes of e-waste per year by 2050, there is literally a silver lining in the amount of e-waste we produce: As much as 7% of the world's gold may be contained in e-waste.

The idea, says Professor Dean Brady, Head of the School of Chemistry at Wits, is to create a circular economy, where everything that is used can be recycled, reused, or repurposed into new products. "We have a lot of rare earth metals in phones that we can re-use," says Brady.

According to the PACE joint report, there is 100 times more gold in a tonne of e-waste than there is in a tonne of gold ore. Furthermore, our cell phones, laptops, solar panels, and other electronic devices are crammed with rare earth materials such as platinum, cobalt, magnesium and copper.

ECONOMY OF CIRCULARITY

"Almost everything from your phone can be recycled," says Brady. "Our cell phones are going to become the next mines. If we can take all the rare earth metals out of our phones rather than of out of the ground, we can reuse them and create a circular economy."

Currently only 20% of all e-waste is recycled, with the rest either ending up on a landfill or being recycled informally. In a circular economy, almost everything could be re-used or repurposed, leaving very little to go to waste.

Brady and his colleagues are working towards closing the recycling gap, by creating a circular economy from the chemical processes required to mine cell phones.

"While chemistry has changed the world during the last 150 years and has been responsible for major advances in almost every industry, we as chemists are also highly conscious of the impact we have on the environment," says Brady.

Inspired by Wits Professor Roger Sheldon, who is widely known as the "Father of Green Chemistry", Wits chemists are exploring green chemistry practices through researching renewable chemicals, recoverable catalysts for sustainable chemical processes, using CO_2 and green chemistry through using enzyme reactions for anything from biofuels to pharmaceuticals and food ingredients.

"There is a huge wealth disparity across the world, and the great demand for more and cheaper products implies that we would need to manufacture about four times what we are manufacturing currently. However, we already have the sustainable [carbon] footprint of 1.7 Earths [we are currently using the resources of 1.7 Earths to sustain ourselves], so we are going to need to produce about three to four times as much as we currently do with half the environmental footprint we now have," says Brady. "This is a tall order."

The School of Chemistry is working on new technologies such as green chemistry through renewable chemicals; finding recoverable catalysts for chemical reactions through using CO_2 as a catalyst and using biocatalysts to produce anything from biofuels to pharmaceuticals and food ingredients.

THE ALCHEMY OF GREEN CHEMISTRY

Professor Charles de Koning, lead on the project to find renewable chemicals, says: "Crude oil is the basis of our chemicals industry, but this is not sustainable. Not only is the supply of crude oil finite, but our use of fossil fuels is releasing carbon deposited over millennia into the atmosphere as carbon dioxide, which will result in climate change."

The School of Chemistry is developing and using new products derived from biomass to replace fossil fuel-based chemicals, which will result in neutral net CO_2 production.

"New technologies in chemical catalysis, bio-catalysis and biotransformation, flow chemistry, and bio-refineries will contribute to a more sustainable circular economy, with reduced waste, as defined by the Environmental (E)-Factor developed by Professor Roger Sheldon," says Brady.

Ultimately, this green chemistry can galvanise a circular economy that can recycle cell phones to greenbacks. Sustainably. C

HANDS OFF OUR GRASSLANDS

SHAUN SMILLIE

Grasslands are vastly biodiverse areas and vital for the sustainability of human wellbeing.

In the north eastern Free State, a 60 km green corridor is being created that will link the upper Wilge Protected Environment to the Sneeuwberg.

The plan is to create a place of refuge for the bird species that are threatened by climate change and the destruction of South Africa's grasslands.

It will be an add-on to the already 17 456 hectares that became part of the Sneeuwberg Protected Environment in 2016.

For Dr Melissa Howes-Whitecross, who works for BirdLife South Africa and is a Visiting Researcher at Wits' School of Animal, Plant and Environmental Sciences (APES), it is one answer to South Africa's dwindling unique grassland habitats.

As grasslands dwindle, so too does the biodiversity they sustain. Grassland mammals like Oribi and grey rhebok have experienced population declines, while grassland bird species have been particularly hard hit.

The bird that graces South Africa's coat of arms, the Secretary bird, has lost 50% of its population over the last three generations. To blame is habitat destruction, hunting and poisonings.

Other bird species are also being affected by climate change. "Many of our grasslands are high altitude grasslands. We are finding that birds like the Yellow-breasted Pipit are extremely sensitive in terms of their breeding when it comes to average temperature increasing. So, there is a definite threshold where breeding fails," says Howes-Whitecross. "We are very concerned for these high-altitude grassland species."

The work towards creating green corridors is one of the first steps in protecting some of South Africa's most unique biodiversity, its grassland biome.

"One of the big problems about grasslands is that they are centered around places like Joburg, Bloemfontein and Pretoria, which means it is some of the most expensive land in the country," explains Professor Ed Witkowski, Head of the Restoration and Conservation Biology Research Group, and Professor of Plant Ecology at APES.

"There is a lot of mining activity in the area, it is valuable for agriculture and they have planted a lot of forests. So, declaring large areas of grasslands as nature reserves is expensive."

If the grasslands are wiped out, the loss will eventually impact the humans who were responsible for the destruction in the first place.

"It is a necessity for human well-being to have intact ecosystems. If you take a wetland, which usually falls within a grassland area, for example, they are vital for storing water, cleaning water and preventing floods," says Howes-Whitecross.

The Sneeuwberg Protected Environment happens to lie within a strategic water source area, which feeds rivers that provide water for many of South African cities. In a water-scarce country like South Africa, access to clean water is becoming a crisis,


Photo by Pole-Evans taken 1917/10/30

particularly for poorer communities.

As a recent study has shown, however, it is important that the right research is used in the fight against climate change and habitat destruction.

A paper by European scientists that appeared in *Science*, claimed that global tree planting could rid the planet of a third of the CO_2 emitted since the industrial revolution. Africa's grasslands were suggested as a prime spot to plant large numbers of trees.

In a technical comment that was published as a response to this article and, also published in *Science*, 46 scientists – including Wits ecologist Professor Sally Archibald – warned that such large-scale afforestation could destroy ecological systems and do little to reduce CO_2 levels.

"Firstly, their numbers are wrong," says Archibald. "It is irresponsible to give people false hope that our global change problems can be fixed in this way. Secondly, the impacts on our natural ecosystems in Africa would be devastating."

FAMOUS VELD FLOWER

Near the town of Haenertsburg in Limpopo, Sylvie Kremer-Köhne, an MSc graduate from APES is trying to make a small rare plant species famous.

Aloe lettyae has been made a flagship species for grasslands, meaning it has – much like a rhino – been chosen to be an ambassador for a particular habitat.

The aloe was described in 1937 and, until recently, little was known about its biology.

"It is our flagship species because it only occurs in the critically endangered Woodbush Granite Grassland, of which very little is left," says Kremer-Köhne. "So the first job was to figure out just how many populations there are, and where exactly they are."

The count revealed 10 800 plants clustered in several population groups.

Over the last century, exotic timber plantations – exactly what Archibald warns against – are believed to have destroyed more than 90% of the original Woodbush Granite Grassland. What is left is now squeezed onto small fragmented pieces of land.

> "Large-scale afforestation could destroy ecological systems and do little to reduce CO_2 levels."

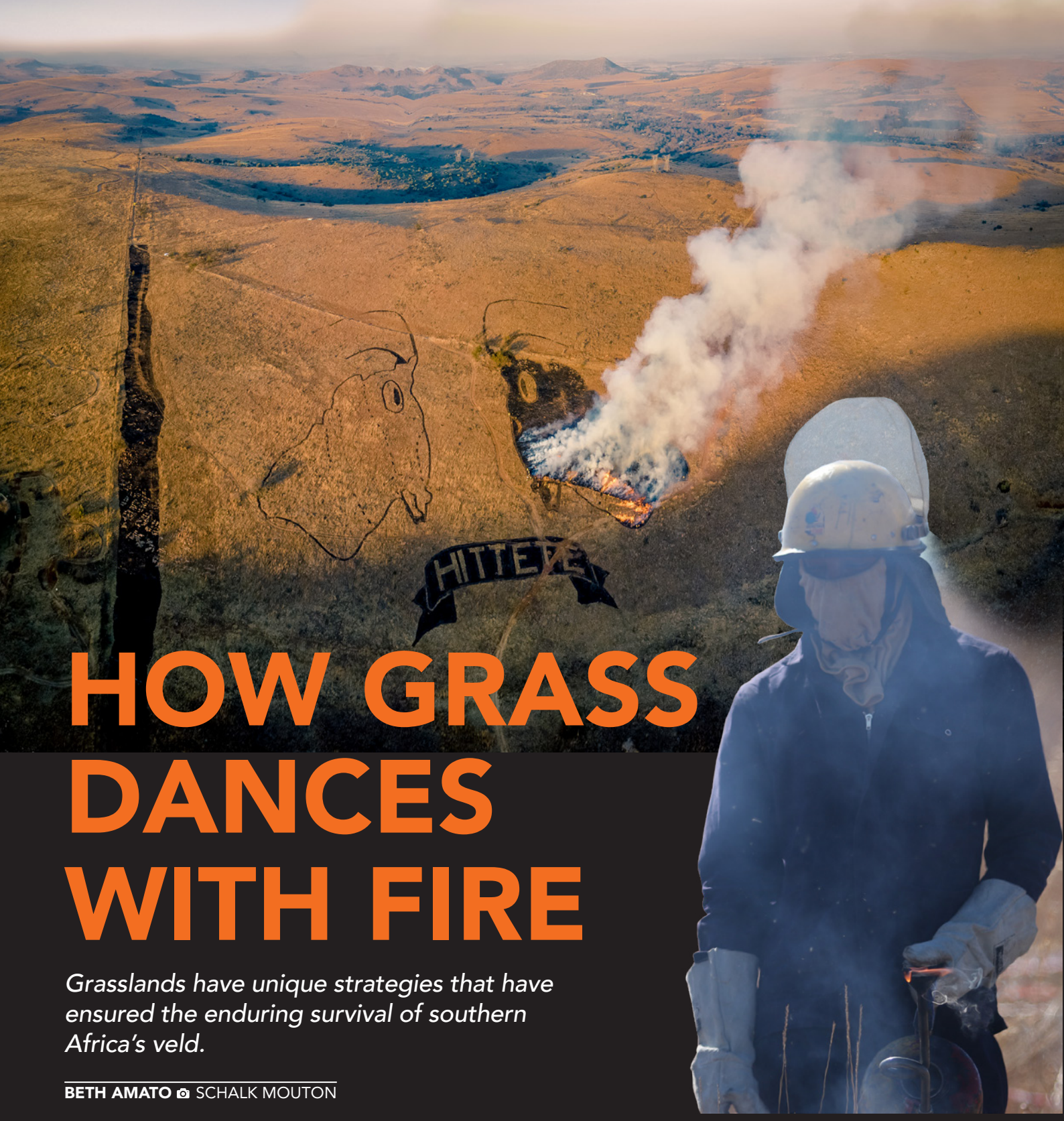
In 1917 botanist Illtyd Buller Pole-Evans took a photograph of the Magoebaskloof, which lies close to Haenertsburg. A century later, a photographer stood in the near same spot as Pole-Evans and took an image of the same mountain.

What it revealed was how the Woodland Granite Grassland had been wiped out over the course of a century. Back in 1917, when the photograph was taken, the mountain was blanketed in grassland. By 2017, Magoebaskloof was covered by heavily wooded vegetation.

To Witkowski, the two photographs show the devastating effect humans have had on the environment. "You see a combination of plantations and bush encroachment," he says, adding that the bush encroachment on the mountain was most likely fuelled by global climate change and altered fire regimes to protect the plantation trees.

The biggest remnant of this grassland type is now protected in a 126 hectare provincial reserve that has been established just outside Haenertsburg. However, Kremer-Köhne believes it is not enough. Other measures need to be taken to protect this crucial ecosystem, such as ongoing efforts to teach farmers to farm in a way that minimises their impact on natural grasslands.

But, ultimately, it comes down to changing the way humans think about themselves. "As humans we often forget that we are just another cog in a big natural wheel that is turning," says Howes-Whitecross. C



HOW GRASS DANCES WITH FIRE

Grasslands have unique strategies that have ensured the enduring survival of southern Africa's veld.

BETH AMATO 📷 SCHALK MOUTON

There's a long-held myth that Johannesburg is the globe's largest urban forest, resplendent with an annual purple Jacaranda show. But before the planting of these (alien) trees for timber during the Gold Rush in the 19th Century, Johannesburg was a rich and varied grassland – a biome [community of plants and animals] that is one of the least protected in South Africa. Fortunately, the Department of Environmental Affairs prohibits plantation forestry in our grasslands, because of the negative impact it has on water resources and biodiversity.

Sally Archibald, Associate Professor in the School of Animal, Plant and Environmental Sciences (APES) at Wits, explains that grass-dominated environments comprise 40% of Earth's land area and they are critical for the livelihoods of much of the developing world. The Food and Agriculture Organization of the United Nations has made the preservation of such grasslands a priority.

FIRST FIRES AT FRANKENWALD

Grasslands are Darwinian gold medalists – they have adapted to almost all environmental stressors, including grazing animals and freezing temperatures. Some people might find it hard to understand, but protecting delicate grassy ecosystems requires fire. Controlled burning brings new life and enables grazing animals to benefit from the lush regrowth after fire.

Wits researchers were amongst the first to recognise the benefits of fire in grasslands, back in the 1920s. Professor John Phillips and his successor, Professor Edward Roux, demonstrated to farmers, land managers, and the global research community

that the fires across the Highveld grasslands every winter were not unwanted destructive forces, but an essential ecological process. Their experiments took place at the Frankenwald Research Station, north of Alexandra township.

Although there is no longer active research at Frankenwald, grassland research at Wits continues. Archibald and the APES team are working on projects to understand interactions between fire, drought and herbivory in grasslands across southern Africa. They are doing this with large regional sampling campaigns, as well as greenhouse and field experiments.

"In the Kruger National Park, we have shown that you can use fire to manipulate grass communities to benefit wildebeest grazers, and we are now investigating how this impacts insect, bird, and microbial diversity, as well as tree seedling establishment," says Archibald.

FANNING THE FLAMES

The researchers also want to assess how drought tolerance strategies in perennial C4 grasses [warm season grasses, four carbon atoms] affect flammability, and whether changes in grass communities associated with drought can feedback to affect fire regimes. Wits postgraduate student, Londiwe Mokoena, found vast differences in flammability across grass species exposed to drought.

"Each species has a different strategy. Identifying links between drought and fire will help us to manage natural grasslands and to pick appropriate species to grow in different rangeland environments. It will also allow us to understand how fire regimes in natural grasslands might change in the future, as rainfall patterns and grass communities change," says Mokoena.

CHANGING THE LEOPARD'S SPOTS

Since wildlife poaching in Africa became a critical conservation issue, Chinese people have been portrayed as ruthless in the apparent pursuit of wildlife body parts. The Africa-China Reporting Project in Wits Journalism warns of "the danger of a single story".

BETH AMATO 📷 THILO BECK

Nigerian writer Chimamanda Ngozi Adichie spoke about the "danger of a single story" in a widely shared TED talk. Indeed, the narrative of a rapacious Asian Tiger persists in portrayals of Chinese people as ruthless poachers.

The Africa-China Reporting Project (ACRP) explains that it's erroneous to peg Chinese people as the villains in what turns out to be a complex set of circumstances and responses.

The Project is a mechanism for breaking down dominant narratives about China generally, and in wildlife conservation specifically.

"Reporting on China and its burgeoning social, political and economic relationships in Africa was often black or white – China was either seen as a predator of Africa's resources, or a benevolent contributor in a place to bolster failing infrastructure and economies," says Project Coordinator, Barry van Wyk.

The ACRP's mission is to enable journalists to "cut through the rhetoric, stereotypes and generalisations" and find a way to access the real stories defining China-Africa relations "on the ground." Understanding these dynamics and reporting them holistically will do more to advance a wildlife conservation and anti-poaching agenda constructively.

WILDLIFE CRIME REPORTING

The Project enables journalists from Africa and China to craft rich stories on environmental sustainability, community development and the dynamics of Africa-China relations in the context of wildlife crimes.

"We want to probe what the untold stories are. What are the on-the-ground perspectives and daily realities? What are the impacts on communities that live close to national parks?" says Van Wyk.

A story in 2017, for example, featured a description by an African journalist of how pangolins are poached in rural areas in Cameroon and transported to the cities, and an exposé by Chinese journalists of an elaborate criminal pangolin smuggling network that passes through Hong Kong, Singapore, South Korea and Mainland China – but the story also depicted the many volunteers in Mainland China and Hong Kong fighting the scourge of pangolin smuggling.

Journalists at the Wildlife Poaching and Trafficking Journalism Training Workshop, a collaboration with the World Wide Fund for Nature (WWF) in Hoedspruit on the border of the Kruger National Park, from 9 to 12 July 2019 found that the poaching discussion had been racialised, and tended to portray the image of Asia rising in Africa, or East Asians encircling Africa's wildlife. The blame for illegal wildlife trade was usually assigned to several scapegoats such as China and Vietnam, corrupt officials, and incompetent governments.

Furthermore, illegal wildlife trade lacked in-depth reporting, said Christel Antonites, Queensland University of Technology, who analysed how the media covered illegal wildlife trade.

"Most stories focus on events at the expense of context and the factors behind the phenomenon. Communities living around national parks, for example, have to contend with complex socio-economic realities that are a result of colonialism, apartheid, and civil war. However, in media reporting on illegal wildlife trade, these are usually just add-ons."

WOLVES IN SHEEP'S CLOTHING

In 2015, Chinese journalist Shi Yi spent three months investigating wildlife crimes in Namibia. Shi Yi focused her narrative journalism on Booysen, a wildlife poaching middleman:

> *Booysen comes from a village close to Katima Mulino and lives with his mother…After showing me the lion skin, Booysen said [if] I wanted to buy ivory, I'd have to wait for a couple of days since he needed to get the tusks from friends…*
>
> *According to the United Nations Development Programme, 31% of the 2.3-million people living in Namibia live on less than US$1.25 a day, and most of the poor live in the north.*

A policeman combating wildlife crime told me there are poachers and middlemen on the supply chain. The middlemen, often found to be locals or from neighbouring countries, hire poachers or simply buy the goods from them, and then sell it to Asian buyers.

Booysen might be a middleman in the illegal trade. When I asked about his suppliers, he answered: "My friends get that stuff for me. You can count on me."

I agreed to wait two days for the ivory…. The police were tipped off and were waiting at the agreed venue when Booysen and his friends arrived at the agreed meeting time.

Before he was arrested, Booysen was in a party mood as I shook hands with him and his friends in greeting … On October 5, two days after the arrest, Boysen and his two companions were charged with illegal possession of wildlife products.

Shi Yi, an ACRP-funded journalist, won Journalist of the Year at the 2016 China Environmental Press Awards.

GRAPEVINE JOURNALISM

In 2013, the Africa-China Reporting Project and environmental investigative journalism unit, Oxpeckers, supported two Chinese journalists who were reporting in Nelspruit on the border of the Kruger National Park.

Chinese journalist Huang Hongxiang investigated the role that Chinese nationals play in the thriving rhino horn trade in Johannesburg. His article elicited a heated response from the Chinese Embassy, who then invited him to meet and discuss ways of addressing the illegal smuggling.

The success of Huang's work led to the establishment of China House in Kenya – an NGO supporting Chinese communities in Africa to undertake wildlife conservation activities.

China House, Mara Conservation Fund, Stop Ivory, Humane Society International, and the Africa-China Reporting Project then hosted the Africa-China Wildlife Cooperation Forum held at Wits University in 2015, that also involved the South African Chinese community.

"This shows how powerful storytelling leads to partnerships and meaningful action," says Van Wyk. C

THE CHANGING NATURE OF ACCOUNTING

JORISNA BONTHUYS

The days are gone where companies only have to report on their financial bottom line. It is time for them to report on their impact on the environment.

In a rapidly changing world, companies no longer have the luxury to rely on business as usual, where it comes to accounting and integrated reporting.

As almost every company on Earth has some form of impact on the environment, it is crucial to include the effects that a company has on its social, ecological and economic environment into their integrated reports, which – if done correctly and comprehensively – can even provide a firm with a competitive advantage.

"It can no longer be business as usual," says Professor Warren Maroun from the Wits School of Accountancy. "Companies have a moral obligation to consider their contribution to the planet's ecological demise and hold the key to unlock much-needed change in society."

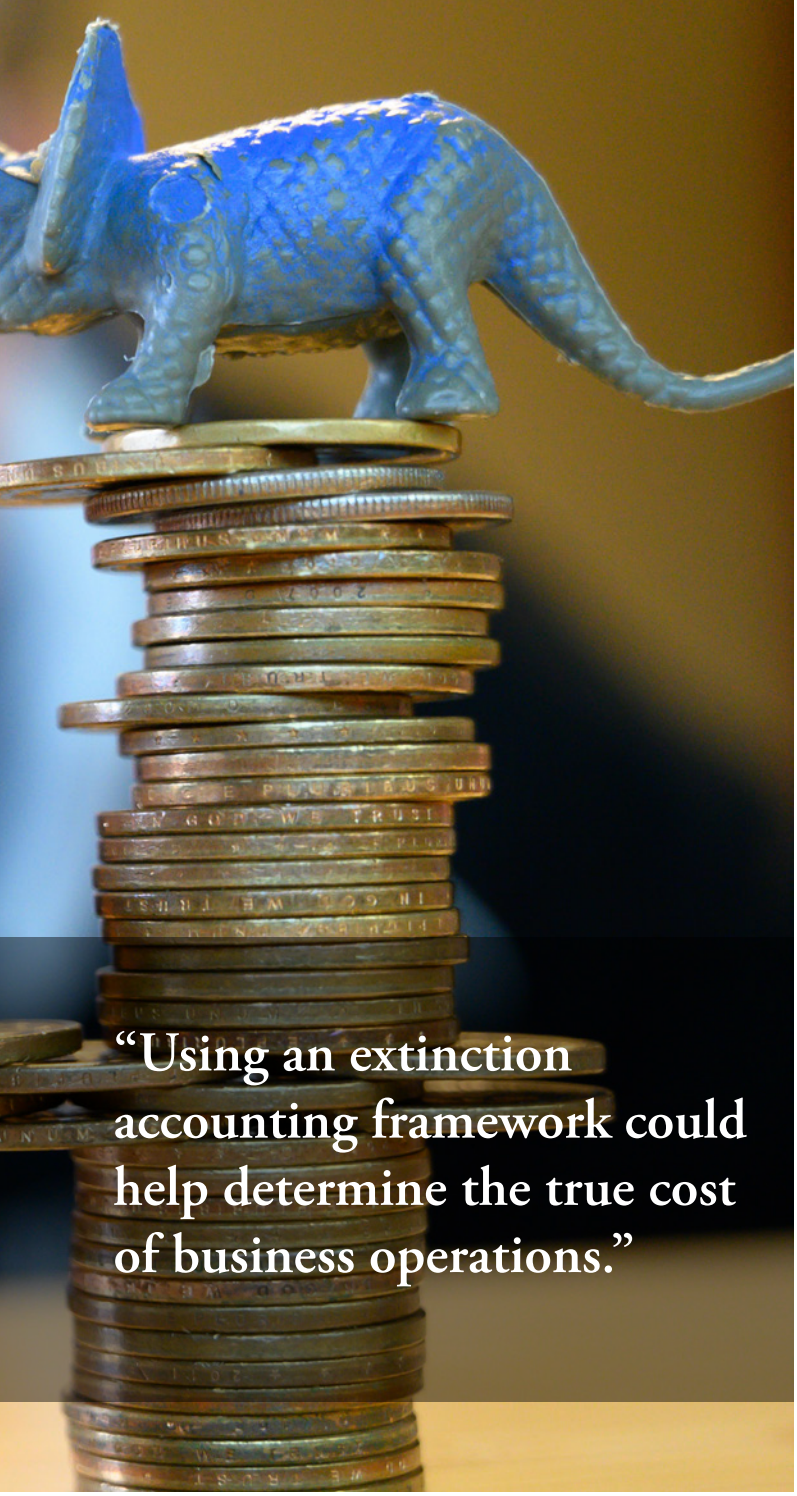
Maroun is collaborating with Professor Jill Atkins, Chair in Financial Management at the Sheffield University Management School in the United Kingdom and a visiting Professor at Wits to create a new accounting framework, called "extinction accounting" that aims to incorporate the effects that business decisions have on issues such as biodiversity.

EXTINCTION ACCOUNTING

"Extinction accounting aims to improve decision-makers' and shareholders' understanding of the impact of their business operations on natural capital. It also considers the effect of species loss on companies' operations and prospects," says Maroun.

This new framework could help protect companies against risks and ultimately empower them to become responsible agents of change for the good of the planet.

Extinction reporting is a framework of accounting and



governance that aims to implement species protection throughout financial markets, through reporting on these issues in the company's integrated report. Ideally, it is designed to deal with the corporate threat posed by the mass extinction of species.

The framework draws on accountancy's change-potential and, rather than attempting to find a substitute for current accounting and accountability technologies, it adds additional layers to corporate reports, making them practical tools to ensure sustainable business development that will mitigate the impact of business on nature.

"Traditionally, accounting was like preparing a tomato soup using a well-known recipe. Now, we are adding some extra textures and flavours into the mix. You could say we are making a minestrone soup, although it still has tomatoes as its main ingredient," says Maroun.

The system "translates" scientific reports on species loss and its impact on the natural world into a form that accountants can easily digest. At the same time, the approach also recognises philosophical concerns about the impact of businesses and capitalist mechanisms on ecological matters.

"Given the current rate of ecological change, this framework could help future-proof companies and reduce their operational risks," says Atkins.

Maroun and Atkins who both have their foundations in accounting, have, for instance, been considering how the accounting system can be expanded to deal with the business risks posed by climate change, habitat destruction and species extinction.

NOT JUST RANDS AND CENTS

By weaving scientific evidence and theory into organisational disclosure and reporting, they demonstrate links between species extinction, business behaviour, accounting and accountability.

An extinction account can take different forms, depending on the species or ecosystems at risk and the nature of the organisation's dependence on the respective natural capitals. Examples of the types of information which may be included in the report include: the cost of environmental remediation; the financial impact of species loss; a review of the reputational consequences of being associated with or contributing to the loss of species and a broader account of the social and cultural ramifications of extinction.

The reporting entity would need to define its responsibilities and levels of accountability and give an assessment of the relevant economic, environmental and social risks. Strategies for mitigating these risks, the capitals required to execute its plans and the consequences of failure (in both economic and biological terms) would also need to be clearly explained.

AVERTING AN ECOLOGICAL CRISIS

"The world is facing an ecological crisis and this information needs to be translated for companies' decision-makers," says Maroun. "The impending extinction of species on Earth requires a stretch of the imagination when it comes to accounting. We need more business intelligence to respond to this threat, and extinction accounting can help pave the way."

One only has to take the example of the possible extinction of the humble honeybee, in order to see the possible impact of the extinction of a species on a company's bottom line.

Many pension and investment funds, for instance, have shares in retail companies that buy and sell certain crops like plums. And without honeybees to pollinate these crops, companies have to devise ways in which to replicate the honeybees' pollination service. In countries like China, humans already pollinate crops by hand – at huge cost.

"The loss of the honeybee could cost the economy billions," says Maroun. "This tiny insect is having a massive impact on our economy and the way our agricultural and retail sectors work."

Maroun believes the new extinction accounting framework will enable companies to play a more responsible role in their communities in future.

"Using an extinction accounting framework could help determine the true cost of business operations," he says. "It makes good business sense to do it." C

READ MORE ON THIS RESEARCH:

- www.researchgate.net/publication/322628605_Integrated_extinction_accounting_and_accountability_Building_an_Ark
- www.sciencedirect.com/science/article/pii/S0155998217301692

THE BEAUTY OF A GOOD GREEN DEED

Wits alumna Lungo Katete is determined to do good for the environment and her passion for environmental conservation earned her the Miss Earth South Africa 2019 crown in September.

REFILWE MABULA 📷 LAUREN MULLIGAN

An early fascination with the environment sparked an interest in its protection. When it comes to the environment, she finds it "interesting how everything no matter how big or small serves a function".

Katete entered the Miss Earth South Africa pageant "to inspire future generations and make a difference in the state of our environment." The 22-year-old Wits architecture graduate says the unappealing state of our environment irks her.

"We often look at waste surrounding us and do absolutely nothing. It is almost as though the waste we see everywhere has become our everyday norm. Even though we see what is happening, we are not doing enough to deal with the problems regarding our environment," she says.

ANTI-PLASTIC EARTH ADVOCATE

"Love the Earth as you would love yourself. Earth is our home, the only one we've got. So it is important that we give back what we take and nurture our home instead of destroying it," reads a tweet from Katete posted on 10 November 2019.

Her love for doing good green deeds is evident on her social media profile. "All you need to do is one good green deed a day and you're one step closer to achieving the impossible," says Katete, who believes that taking care of the environment should be a collective responsibility.

"All it takes is for each and every one of us to pick up a single piece of paper and not rely on someone else to do it for us. This is our waste, we need to start taking responsibility and being held accountable for our actions," she says.

As Miss Earth SA, one of Katete's duties is to raise awareness around preserving and protecting the environment and the planet, and she is an ambassador for environmental protection campaigns. Her greatest concern is plastic, which takes thousands of years to decompose and thus threaten the environment.

"I would like to see people using less plastic because plastic has a very negative impact on the environment. We use straws and plastic bags once and after that, they are thrown away never to be used again. Plastic that is not recycled ends up in a landfill and is then blown away by the wind and ends up in our lakes, rivers and oceans. These small pieces of plastic end up being consumed by birds, fish and many other species, resulting in their death," she says.

#WASTESTOPSWITHME

Katete is an ambassador for the Good Green Deeds Programme through which she educates learners about being environmentally conscious and the power of a good green deed daily. The Good Green Deeds Programme is an initiative of the Department of Environmental Affairs. The programme aims to influence the behaviour of South Africans to avoid dumping and littering and promotes knowledge of proper waste management.

The #WasteStopsWithMe campaign in which Katete was involved calls on citizens to actively take a stand against damaging the planet and to take responsibility for the environment they inhabit.

> "We think it's impossible to salvage what is left of this planet, but the change starts with every little decision we make in our daily lives."

"My aim is to help people understand that this is our planet and we are responsible for taking care of it as much as it takes care of us. We are damaging our planet and the only way we can move forward and make a change is if waste stops with me," says Katete.

CONSTRUCTING A CAREER IN ARCHITECTURE

Architecture as a science and art is omnipresent and young Katete was intrigued by the design of the beautiful buildings she saw on television. Her love for architecture evolved and she aspired to work in the field.

"My love for architecture began in 2010, when I saw the Park Towers building on one of the engineering shows my father used to watch, where they discussed and showed the process of designing and constructing a building," says Katete, who grew up in Midrand.

The Park Towers are beautifully engineered skyscrapers in Dubai designed by globally renowned firm, Gensler Architects. Katete's visualisation of the Park Towers as a giant 3D puzzle ignited a flame: "I discovered my ability to create in my mind art that one can live in."

Nine years after experiencing that inspirational design, the beauty queen completed her degree in Architectural Studies at Wits and is now an architectural technologist at Kamo Architects in Gauteng. She is responsible for drawing, detailing and occasion designing. Being able to bring her design ideas to life through construction is what attracted her to the field, and she is enthusiastic about her work, which inspires creativity and innovation.

"It amazes me how as individuals we are able to create things that manifest as a thought and that through construction come to fruition," she says. "I love immersing myself in things that are an expression of me and my thoughts, which is where architecture comes into play. And I want to inspire."

IMPOSSIBLE IS A DARE

Katete believes that self-care is essential in caring for others. "To save our planet we need to take care of our spaces and our home, then we will know the value of taking care of our environment, because it is an extension of our home," she says.

More importantly, she wants to combine her advocacy, passion and creativity to make a meaningful social impact in South Africa.

"I hope to change the minds of our generation and help them see the bigger picture. I always like to say 'impossible is not a declaration, it is a dare!' We think it's impossible to salvage what is left of this planet, but the change starts with every little decision we make in our daily lives."



AN EVOLVING UNDERSTANDING OF EXTINCTION

Earth is where we live our lives and the palaeosciences seek to understand the origins of past life. Palaeoscientists are uniquely placed to interrogate the Earth's geological records, the origin and development of life, biodiversity change, and extinctions.

Few things related to science capture the imagination more than the magic of worlds past. This includes the origins of life, dinosaurs, mass extinctions, meteorite impacts, and the evolution of our species. Understanding the evolution of life is central to the way we view ourselves and others and developing this field is thus critical. Furthermore, South Africa's rich palaeontological, palaeo-anthropological and archaeological record provides a unique competitive advantage to local heritage-related scientists.

Palaeosciences is the only discipline dedicated to understanding the origin and development of past life and its interactions with changing environments. It is the responsibility of these scientists to ensure understanding of the depth of our dependence on Earth as a life support system. Additionally, paleosciences research can provide knowledge of how to manage human interactions with the planet responsibly. As our knowledge of the Earth expands, we begin to realise far more synergy and mutualistic relationships with the biological world – built up over millions of years – in many of the fundamental processes to secure biodiversity, soils, water, minerals, energy, and other resources.

SOUTH AFRICA ROCKS

South Africa is poised to become a global leader in an area of geographic advantage. Because of the country's immense diversity, antiquity, and continuity of geological, palaeontological, and archaeological records, and its rich genetic heritage, South Africa is unique in the world. The country boasts some of the most significant mineral deposits on Earth and preserves, amongst others, the oldest evidence of life on Earth from over 3 500-million years; the most distant ancestors of dinosaurs from 200-million years ago; and a remarkable record of human origins and achievements over four-million years.

ERASING EARTH

The study of past biodiversity has recognised that five global extinction events have occurred in the last 500-million years, where between 65% and 95% of species went extinct over a relatively short period. South Africa has a record of four of these five extinction events. Many scientists consider that the Earth has now entered a new epoch – the Anthropocene. Like other transitions between geological eras, the marker for this transition is a mass extinction event, although this one – uniquely – is human-induced. And avoidable.

The current rate of species extinction is estimated to be 10 to 1 000 times higher than the natural, background rate. This is likely to increase as habitat destruction, global change, and other human-induced stresses on the natural environment accelerate.

South Africa is the only country in the world with the necessary fossil resources to undertake a research initiative over such an extensive period. Our fossil archives provide case studies throughout Earth's history to understand how climactic and environmental change affect biodiversity.

Decoding the mechanisms that lead to population extirpation [localised extinction] and ultimately species extinction under climate change is critical for scenario-planning, interpreting, and possibly predicting its impact on biodiversity and to inform policy to conserve South African biodiversity in future.

Dr Christine Steininger is Manager, and Professor Bruce Rubidge, Director, of the Department of Science and Innovation-National Research Foundation Centre of Excellence in Palaeosciences at Wits University.

LIVING YOGA FOR THE MIND

Plants in the office are not there just to look pretty. They can lead to increased productivity, as well as improved mental health for workers

RESHMA LAKHA-SINGH 📷 LAUREN MULLIGAN

We all know that taking a walk in the garden or going for a run in the park after work can do miracles for getting rid of the stress of a hard day in the office. Greenery and plants have been recognised all over to have some kind of calming impact on us. For example, Apple Inc.'s four storey circular building in Cupertino, California, nicknamed the "spaceship" is filled with drought-resistant trees and indigenous plants. Microsoft employees at the Redmont Campus in Seattle make use of treehouse boardrooms and Amazon has a look-alike rainforest office space that houses 40 000 plants in downtown Seattle. By recreating "natural" spaces, these multinational corporations hope to encourage and enable creativity, mindfulness and innovation amongst their employees through a link to nature.

HEADSPACE

"There are obviously many physical benefits to having plants in the workspace but the reality is that in order to truly feel the real $C0_2$ and 0_2 transference, you have to have a jungle in your office," says Professor Andrew Thatcher, Chair of Industrial and Organisational Psychology and a specialist in green ergonomics at Wits.

"However, the psychological benefits based on Attention Restoration Theory (ART) hypothesised by University of Michigan Professors Rachel Kaplan and Steven Kaplan, indicate that nature is not only pleasing to the eye but can also help concentration and renew mental energy. It provides an escape from our normal indoor sterile environments."

Interested in the study of the reciprocal relationship benefits between human and nature, Thatcher investigated the psychological benefits of plants in the office after seeing a similar study conducted in the northern hemisphere, in countries with severe winter conditions.

"We wanted to replicate the study in a country with warmer temperatures that enable plants to survive all seasons," says Thatcher.

He placed groups of participants in three rooms. The first room had plants, room two had pictures of plants, and the third room was bare. All participants were given tasks to complete. The results indicated that performance was best in the room with plants, thereafter the room with pictures of plants and the worst result was the sterile environment.

"Another case study done internationally placed office workers into three groups. One group did yoga in a closed room, another walked the city, whilst the third walked around in a park. The park had the best restoration effect and the yoga studio had the worst. The point was not doing yoga, but getting out into nature," says Thatcher.

He adds that in our constructed environments our attentional capacity becomes shortened the longer we spend in those environments.

"The type of work we do is highly cognitive and very stressful. Our escapes are talking to others but very often we talk about work. We don't get an opportunity to recoup our attentional resources, therefore you need a way of topping up those attentional resources. Plants enable us to do this," says Thatcher.

"Many of us spend so much time interacting with technology, cooped up in closed offices. Our jobs require us to solve problems, multi-task and pay attention to detail. Our daily lives are filled with ambient noises such as alarms, ringing phones, television and sirens – the list goes on. So, plant up your office space, it may just be the yoga that your mind needs."

CLIMATE ENGINEERING:

SAVING THE WORLD OR SMOKE AND MIRRORS?

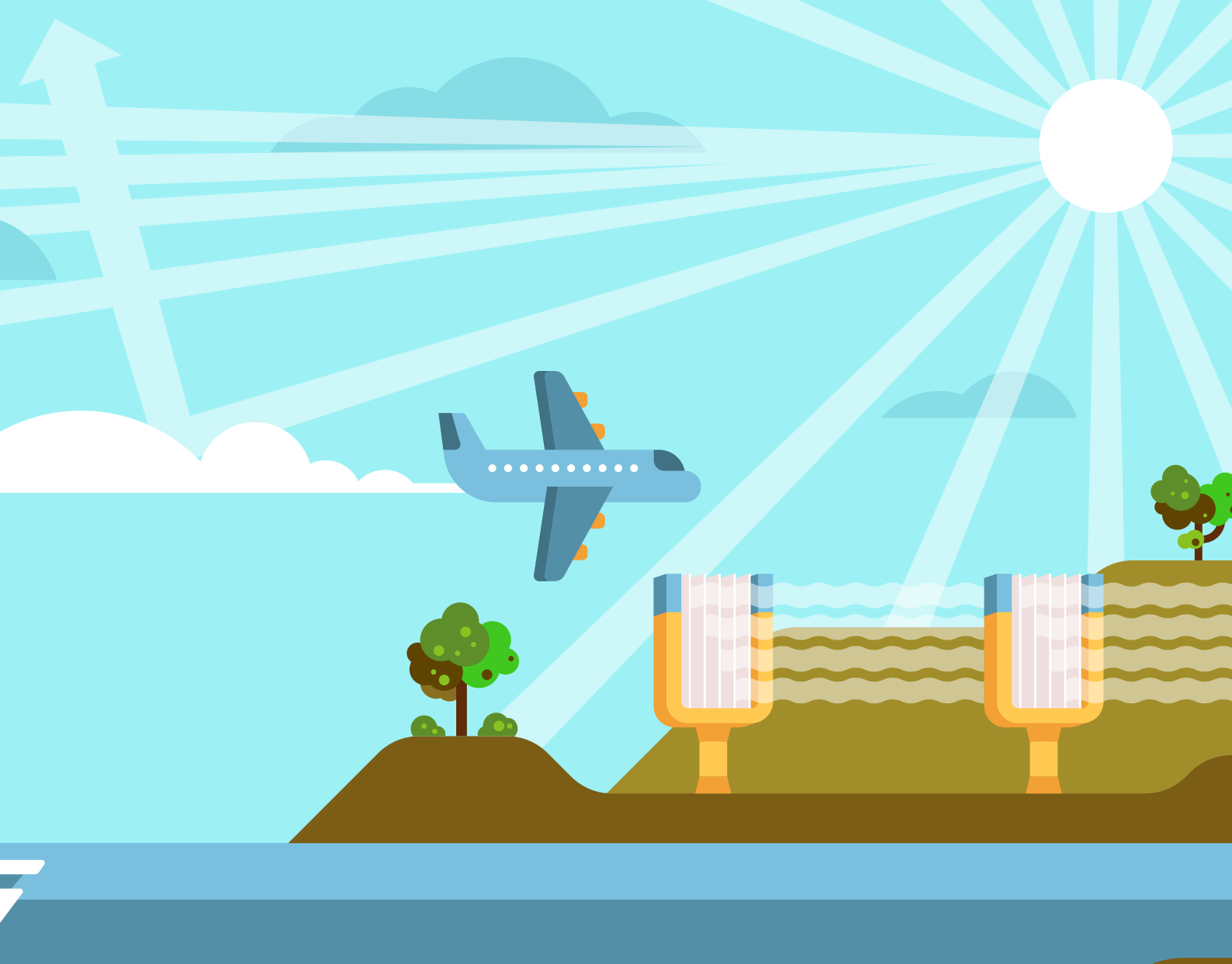
Climate engineering may offer a last-ditch technological solution to catastrophic climate change, but who makes the decisions on which solutions to implement, and who the beneficiaries will be? Once we start fiddling with the Earth's fundamental processes, where will it end? Schalk Mouton asks Professor Bob Scholes.

What exactly is climate engineering?

Climate engineering, formerly known as geoengineering, are big-scale technological solutions to fight climate change if we fail in doing the obvious thing, which is to urgently and radically reduce global emissions of greenhouse gases. It includes ambitious and largely untested technologies that could keep the world liveable, if not exactly ideal.

Can you give examples of some of the ideas being researched? Are any viable?

One example of climate engineering is Carbon Capture and Storage, which involves taking CO_2 streams from industry, compressing them, and injecting them deep underground into places where they can't escape back to the atmosphere. This approach is technically possible and proven at moderate scale,



but it is very expensive. Another example is the fertilisation of the oceans with iron, to promote phytoplankton growth. Phytoplankton absorb CO_2, die and sink to the ocean floor, thereby burying the carbon deep in the ocean. This has been tested at small scale, but it does not work very well and has lots of unintended consequences. There are about 10 other serious contenders, such as the plan to inject shiny sulphur particles into the stratosphere to reflect some solar radiation.

Why is climate engineering controversial?

For climate engineering to work, it has to take place at massive scale, and is therefore sure to have lots of side effects which we don't yet understand. Secondly, it may seem to many to be a 'get out of jail free' card, which distracts us from doing what we know we have to do, but lack the political will. Thirdly, there is the question of who makes the decisions on what global measures to take, and who the main beneficiaries will be, since the outcomes are patchy.

What are the pros and cons of climate engineering?

Pro: It could save the lives of future generations.
Con: It could fail, in which case it would have stopped us from doing the things we should have done earlier, such as decreasing our greenhouse gas emissions. There are a lot more cons too, such as unintended consequences, impermanence, and inequities in governance or decision-making.

If we are in a climate crisis, should we not try anything to remove the threat, and would engineering solutions be a reliable, sustainable option?

We need to explore these solutions well before we are in crisis mode. We know what our options are. Some climate engineering ideas are quite benign and may be good things to do anyway.

Are there any climate engineering projects going on in South Africa? Why or why not?

Yes, there is work on Carbon Capture and Storage going on at the South African National Energy Development Institute. The Global Change Institute at Wits is about to begin a major project looking at the potential and problems with four climate engineering ideas, which could find application in South Africa.

Any further thoughts on climate engineering?

There are two main sorts, carbon removal technologies and solar radiation mitigation. The former is much more benign, but the latter may offer some apparently cheap and quick but temporary fixes, which a wealthy country or individual might be tempted to undertake unilaterally, without properly examining the consequences. C

ROCK STEADY, GRASSY GREEN

Wits law student Ruth Krüger reflects on former Constitutional Court Justice Edwin Cameron's critical jurisprudence and the environment.

Gallo images

On 20 August 2019, Justice Edwin Cameron delivered his last judgment as a judge of the Constitutional Court, and law students everywhere groaned – not in response to the judgement (in which he lambasted government for its failure to assist labour tenants on farms, and made an unprecedented and creative order), but because there will be no more Justice-Cameron-judgments and his fan club is not sure what to do with their time. There has been talk of knitting. Or white-water-rafting. Anything to fill the void.

LANDSCAPE OF ENVIRONMENTAL LAW

I'm making light of it, but the fact is that Justice Cameron has quite a following amongst Wits law students. It's not surprising. He's just as well known for his forthright, wide-reaching legal decisions as his unshakable personal strength. As a proudly, openly gay man living with HIV, Justice Cameron has rallied countless South Africans. And at the symposium hosted by the Wits School of Law in his honour on 4 September 2019, we also learnt of his kindness and thoughtfulness – he memorised the name of practically every participant in the space of a day.

Arguably less well known about Justice Cameron is the importance of his judgments for environmental law – a field in its infancy in this country and globally. South Africa's Constitutional Court has had scant opportunity to engage with environmental issues, but there are principles in Justice Cameron's judgments that set up a rock-steady foundation for environmental law. It is just one of the ways in which Justice Cameron has established a valuable legacy.

EMPOWERING LOCAL GOVERNMENT FOR SUSTAINABILITY

The first important principle Justice Cameron gave us for environmental law relates to the powers of different spheres of government in planning decisions. In the *Habitat Council* case, Justice Cameron ruled that municipalities have independent planning competencies, which are not subject to review by the province. This reminds us that some decisions *need* to be made at the local level, and that this is also a sustainability issue. Mismatches of scale have very real results in environmental governance. This has been seen for example in the Sahel desert – thought for years to be growing when in fact it was just moving but being studied at too small a scale. Thus, the powers given to levels of government at different spatial scales may have significant environmental consequences. It is important that local government powers remain real powers.

GIVING VOICE TO THE UNDERMINED

The next principle comes from the *Liquor Bill* case, where part of a Liquor Bill was declared unconstitutional as the provinces had not been consulted sufficiently. Justice Cameron was making a powerful statement about the principle of stakeholder involvement, which is crucial in environmental rights. For example, Mpumalanga province, pockmarked with mines and coal-fired power-stations, has the highest rate of nitrogen dioxide pollution in the world. An NGO called Centre for Environmental Rights does excellent work with communities there, who are commonly poor, wracked by respiratory disease, and have very little say in decisions that affect them and their environment. For such people, better systems of stakeholder involvement could literally be life-changing.

"He pointed clearly to our responsibility as humans, as well as the strange fact that animals, despite being sentient, have no power within the law."

ANIMAL RIGHTS

In both decisions, Justice Cameron built on existing constitutional principles. However, at other times, Justice Cameron has not been afraid to reach outside of the existing legal framework to promote constitutional values. *NSPCA v Openshaw* is a case in point. Here, the NSPCA [National Council of Societies for the Prevention of Cruelty to Animals] had applied for an interdict to prevent Openshaw from engaging in acts of animal cruelty. Most of the court found that the requirements for an interdict had not been satisfied – but Justice Cameron chimed in. He pointed out that "though animals are capable of experiencing immense suffering, and though humans are capable of inflicting immense cruelty on them, the animals have no voice of their own. Like slaves under Roman law, they are the objects of the law without being its subjects".

Justice Cameron would have granted the interdict, as Openshaw had contravened the statute, and had not given any assurance that he would not do so again. Justice Cameron's comments make an important contribution to thinking about animals and the law. He pointed clearly to our responsibility as humans, as well as the strange fact that animals, despite being sentient, have no power within the law.

GREENER GRASS ON THE LEGAL SIDE

In the judgments, Justice Cameron never failed to show us that law is a tool to achieve just ends – nothing more. Where there is a problem in the law, he never hesitated to say so. His legal decisions have established the rock-steady foundation we law students will need in future. But these principles should not be seen as products of the past – they are alive and will guide us even through new and developing areas of the law, such as environmental law. They are grassy green. C

Ruth Krüger is a sustainability scientist currently studying law at Wits. She holds a Master's in sustainability science from Lund University, Sweden and an undergraduate degree in environmental science and legal theory from Rhodes University. She has worked at the Centre for Environmental Rights.

RISE OF THE AFRICAN ECO-WARRIORS

MITHIKA MWENDA AND PATRICK BOND

In the wake of the US withdrawal from the Paris Agreement in November 2019, Wits School of Governance academics share their perspective on the rise of African climate justice as world elites fail.

Among the several million protesters at the global Climate Strike on 20 September were thousands of Africans. Amongst the two dozen African cities hosting protests, young activists marched in Nairobi, Kampala, Dakar, Johannesburg, Cape Town and Durban. Yet their protest is not new – recall a point 10 years ago, when vocal Africans made the case that the global North was preparing Africa for a climate "holocaust": Copenhagen's 15th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

AFRICAN CLIMATE HOLOCAUST

Sudanese diplomat and a leading African negotiator, Lumumba Di-Aping, used the word 'holocaust' in December 2009, after the leaders of the United States, Brazil, South Africa, India and China conspired to sabotage existing United Nations processes in a small side-room. The Copenhagen Accord was adopted outside the parameters of the main negotiations. Hence, this "league of super-polluters blew up the United Nations," according to Bill McKibben, American environmental journalist and leader of the climate campaign group 350.org.

However, it was also at this summit that a spontaneous protest had erupted from the floor 10 days earlier. Impatient with negotiations, the Pan African Climate Justice Alliance (Pacja) temporarily disrupted the formal event and addressed a rally at a makeshift podium at Copenhagen's Bella Centre.

Chanting "Two degrees is suicide! One Africa, one degree!" and proclaiming "No to climate colonialism! No to climate genocide!", the Pacja activists demanded much greater emissions cuts from the gathered leaders. Supporting the activists, Anglican Archbishop Emeritus Desmond Tutu wrote to the UNFCCC leadership: "We are facing impending disaster on a monstrous scale … A global goal of about two degrees Celsius is to condemn Africa to incineration and no modern development."

In 2011, the UNFCCC summit was held in Africa, but even worse power relations prevailed, as the host South Africa played into the hands of the US State Department. At the summit in Durban, Pacja brought three busloads of activists from as far away as Uganda to participate in a major climate justice protest demonstration outside.

LAST TANGO IN PARIS

In 2015, the major emitters – the US, Europe, China, India, South Africa, Brazil, Russia, Saudi Arabia, Japan, Canada, Australia and Kazakhstan – agreed in Paris on new ways to undermine global climate governance. For example, not only was the *voluntary* character of the Copenhagen Accord reaffirmed, there was no accountability mechanism nor attempt to punish those countries which backslid. When in June 2017, shortly after ascending to the US Presidency, Donald Trump announced he would withdraw the largest historic emitter from the deal, there was no punishment, notwithstanding calls across the spectrum – from Canadian author Naomi Klein, American economist Joseph Stiglitz, and former French President, Nicolas Sarkozy – for anti US sanctions.

Together with its fundamentally voluntary character, another fatal flaw in the Paris Agreement is that costs of 'loss and damage' from climate change are being disproportionately borne by Africans and others who did the least to cause the problems. Thanks to a Paris provision, Africans have no recourse to claim 'climate debt' and polluter liability in lawsuits.

And there are still no compensation provisions, since the dysfunctional Green Climate Fund did not achieve even five percent of its $100 billion per year objective by 2020, as former US President Obama had promised when selling the Copenhagen Accord to those who were sceptical. And no progress was made to enhance African acquisition of climate-friendly technologies that have long been protected by Intellectual Property.

GROUNDSWELL OF AFRICAN CLIMATE ACTIVISM

But while there is paralysis from above, exciting new forms of movement-building from below can be found in Africa.

> "The Copenhagen Accord was adopted outside the parameters of the main negotiations. Hence, this "league of super-polluters blew up the United Nations"

Even the fragmented South African sites of struggle provide a degree of optimism for future unification once they impose substantial pressure on the carbon-addicted government of Cyril Ramaphosa, himself a former coal tycoon.

This mirrors climate justice activism internationally, where the most spectacular new post-Paris movements barely register the UNFCCC as a relevant force. Instead, these activists are committed to direct actions that block high-$C0_2$ activities and corporate polluters, for example, Extinction Rebellion and the indigenous water protectors at Standing Rock in South Dakota.

Simultaneously, the younger generation is already explaining to its elders why UN deal-makers and other high-carbon elites should stand aside. Addressing the UN Climate Summit in September, Swedish youth activist, Greta Thunberg, 16, was furious: "We are in the beginning of a mass extinction. And all you can talk about is money and fairy tales of eternal economic growth. How dare you!" C

Mithika Mwenda directs Pacja and is a PhD candidate in the Wits School of Governance, where Patrick Bond is Distinguished Professor of Political Economy. This is an edited excerpt from the authors' contribution to a book, Climate Change Resistance and Renewal *(London, Routledge, 2020)*

DARE TO CARE IN AN OCEAN OF APATHY AND EXPENDITURE

Schalk Mouton has the Black Friday blues as he considers its impact on his quest to go green, on his green backs, and the implications for Earth

SHOP NOW

It is Black Friday. Getting to work today is easy. There's no traffic. On 702, the traffic reporter makes a joke about traffic being 70 percent discounted. Funny man.

The newsreader talks about queues of shoppers trampling each other just to get ahead in the queue. I can see the pictures in my mind. It is all too familiar. Too fresh.

A BRUISING BLACK FRIDAY

It all started out as excitement at the local Game store the night before. There was such a vibe before the doors opened at midnight. People telling each other what they were going for, the research they had done, their budgets all worked out. I made at least three recce trips to the store in the past two weeks, so that I could find the fastest, shortest route to my favourite bargains.

How I was going to pay for my spoils was of no concern. My budget already blown on two new cell phone contracts and a beach umbrella that I just couldn't resist. My current contract ends in only four months' time, but the deal the telesales person offered just sounded so good. And, after all, what are credit cards for?

3 … 2 … 1 … STORM

The going is slow. Like the start of the Comrades. Just more physical. Push. Shove. Duck from a swinging golden handbag. I feel a kid crawling in between my feet. He's the only person, really moving … brilliant!

I get on my hands and knees and follow him. Going is quicker. Much quicker. Almost at the front of the brawling mob now. I hear people screaming. Shouting. Swearing. Someone faints right behind me. Luckily, I had already passed through, else she would have blocked my way.

But then … a big, juicy, white calf is planted between me and my path to eternal consumer happiness. A tattoo of the familiar Apple Inc. logo stretches across it … looking like a slightly overripe avo.

The sight is not too appetising. Yet, it is the only way I can think of to make it through. I close my eyes, and plant my teeth firmly into the avo … A scream! The calf moves. I dodge the handbag then slip through …

In the store now. Fresh, cool, airconditioned air washes over me. Total bliss.

I realise immediately that I can't waste any time. I am not alone. People are already flooding into the store. I run. Past the fruit and veggie counter, through the stationery section. Into the camping section … the Weber braais are 50 percent off. I hesitate for a moment, but I can't lose focus. I run on.

As I stumble into the entertainment section. Breath wheezing. Heart beating. I stop in horror at the sight confronting me. A man putting up a SOLD OUT! sign on the Playstation 4 display, while a bratty little boy – the very same little critter who led me through the gauntlet at the door – walks away with the last Playstation under his arms. He turns around and flashes a fiendish grin my way.

KEEPING UP WITH THE KARDASHIANS, THE KRUGERS, THE KAKAZAS

Black Friday creepily snuck its way into South Africa's consumer market. A couple of years ago there was no such thing. People happily bought whatever they needed at whatever price they could find. Now, this American consumer ploy seems to have grown bigger than Christmas itself. It is as if everybody lost their faith in Santa Claus…

And, South Africans are not the only ones being led by the nose. In Paris, Amazon is estimated to have made 2.5 million deliveries on Black Friday. This is 10 times more than usual, leading some "greenies" to blockade the road leading out of the company's warehouse in Paris, in protest against the over production and consumerist culture that is being created … not even to mention all the greenhouse gas emissions from the deliveries.

We have been successfully brainwashed into thinking that the more we have, the happier we will be. Everything needs to be bigger, better, smarter and newer. We are trapped in a consumerist lifecycle, and, while it is not all our fault, we are happy to play along.

Every two years our cellphone contracts run out and need to be "upgraded". Six months before the end of your contract, you start to get bombarded about new "deals" for your upgrade. Some companies offer car allowances that in effect force employees to buy a new car every four years. Unlike in the old days where products were built to last forever, they are now built to spontaneously implode in a set amount of time.

Consumer brands spend millions on market and psychological research, aimed at trapping us into believing we cannot possibly live without their product – while a couple of years ago, that product didn't even exist.

DOWN TO EARTH WITH MILLENNIALS

In 2018, while doing my MSc in Global Change, I calculated my environmental footprint. I found out that If everybody on Earth were living the same lifestyle as I do, we would need 2.2 planet Earths to sustain ourselves.

This is shocking. My wife and I are very environmentally conscious. We don't buy stuff we don't need. Both of us have bought our cars over 10 years ago. We re-use water where we can and use resources like electricity sparingly. We even chose not to have children because of the impact each human has on our planet. Yet, my lifestyle is outstripping the very resources we have to live on. And it is not even about us. It is about the generations of people that come after us.

In my research, I interviewed a number of students on how they think climate change would affect them. All were very worried about their future, and how climate change might impact their lives, but none of them knew how to deal with it, or how to change their lifestyles to cope with it. One student – a 24-year-old girl, broke my heart by saying that she would love to have children, but, at her early age, had decided not to, because of the world we are leaving for them.

Two other students taught me that our consumer and lifestyle choices are not entirely our own. Even if we did care about our environment, our infrastructure, society and circumstances influence our actions. The students growing up in rural areas said that due to the lack of municipal services, their waste disposal happens wherever possible – mostly by dumping it in a river or burning it.

Their circumstances make my little environmentalist pet peeve seem petty: For over 30 years, my coffee filters came packed individually loose in a box. Only in the last year – when everything and everyone else is trying to get rid of single use plastics – has the company started to wrap these filters in a flimsy wrapping plastic. Why?

Gathering my breath outside the GAME store. My main mission unsuccessful, I take stock of my loot: a new rolling, perching ergonomic chair; a banana slicer; two packets of baby nappies (I don't have children) and a new tennis racquet at 15% off – even though the closest that I ever come to a tennis court is to watching Wimbledon on the TV set that I looted last year at 20% off.

This can't go on. Whether you believe in climate change or not – and you definitely should – our way of life is unsustainable and should be changed. We need to start to care and make new consumer choices. Only the choice you make when choosing to take out your wallet (or not to take it out), will change things.

Go on, I dare you. Give a damn.

JACARANDAS THEN AND NOW

JENNIFER FITCHETT 📷 SHIVAN PARUSNATH

Jacaranda trees were introduced to South Africa from Brazil in the early 1800s, with the first trees planted in Pretoria. Since then, many Jacaranda trees were planted in Johannesburg and fewer across the rest of the country. Some of those Johannesburg Jacarandas are on the Wits campus, the most notable framing the Great Hall.

Urban legend on campus is that if the Jacarandas start blooming and you've not yet begun studying for year-end exams, it's too late to pass! Conversely, if a Jacaranda flower lands on your head, you'll ace your exam. Indeed, the purple haze across Gauteng in early summer has been well timed with the November examinations, and provides a beautiful display for those staring out of the window while trying to cram in a year's worth of work.

Today's students might find this urban legend puzzling – in 2019, Jacarandas started flowering in mid-September, a full month and a half ahead of the start of the Wits exams, at the beginning of the fourth teaching block. While some students should probably start studying that far in advance, many probably would not be doomed to fail if their notes weren't in order at this point. Does this mean that previous generations of students needed more time to study? No, it means the Jacarandas are blooming earlier than they used to.

Phenology refers to the timing of annually recurring biological events. For plants, these include the timing of flowering in spring, fruit development through summer, and leaf colouration and fall in autumn. In animals, phenology is more diverse and includes the timing of migration, hibernation, egg-laying and hatching. Seasonal changes in the environment trigger these phenological events, which most often relate to the temperature change in the shift from winter to spring.

As the world's climate warms, temperatures previously experienced during the spring months of September and October are now occurring frequently in the late winter months of July and August. This means that phenological events in plants and animals who are triggered by spring events are now occurring in winter. Similarly, early summer is now being experienced in mid-spring. These advances in the timing of phenological events have been observed across a range of flowering plants around the world, including our Wits Jacarandas.

We tracked the timing of Jacaranda flowering in Gauteng over the past century using a collection of articles from *The Star, Rand Daily Mail, Beeld*, and Wits' own *Vuvuzela*. Our study confirms that the phenological advances seen globally are occurring for our Jacarandas. In the past decade, there has been a 2.6 day per decade advance in flowering from 1919-2019, from an average peak flowering date in mid-November in the 1920s to late-September.

These shifts demonstrate the plants' adaptation to the warming climate. However, this advance in the timing of flowering cannot occur indefinitely, because it progressively affects the trees' capacity to take up water, cycle nutrients, and withstand stressors. As Jacarandas are invasive trees, for which replanting is prohibited, the long-term effects on tree health threaten our purple city in early summers. C

Dr Jennifer Fitchett is an Associate Professor in Physical Geography in the School of Geography, Archaeology and Environmental Studies at Wits. Her research is situated in the discipline of biometeorology, exploring climate change over long- and short-periods, and the impacts on plants, animals and people. Postgraduate students Heritage Fani and Kestrel Raik contributed to the research on Jacaranda phenology during their honours degree studies in 2017 and 2019 respectively.

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